

CHEMICAL, ENVIRONMENTAL AND MATERIALS ENGINEERING (CET)

CET 200. Engineering Analysis of Chemical, Environmental, and Materials Systems. 3 Credit Hours.

The use of mathematics and engineering analysis for chemical and physical processes. The use of balance equations and rate laws for describing mass and energy conservation in physical processes with and without chemical reactions.

Prerequisite: MTH 162 and PHY 222.

Components: LEC.

Grading: GRD.

Typically Offered: Fall.

CET 240. Environmental Quality Control. 3 Credit Hours.

Exploration of contemporary environmental issues. Introduction to engineering approaches for protecting and cleaning up the environment, techniques for assessing the impact of human activity on the environment, strategies for pollution control and implementation of environmental mitigation measures. Not open to civil or environmental engineering majors.

Requisite: Sophomore Standing or Higher.

Components: LEC.

Grading: GRD.

Typically Offered: Spring.

CET 300. Computational Methods for Engineers. 3 Credit Hours.

Numerical methods for solving problems commonly encountered in engineering analysis and design. Implementation of numerical methods using software such as Excel and MATLAB.

Prerequisite: MTH 162.

Components: LEC.

Grading: GRD.

Typically Offered: Fall.

CET 330. Fluid Mechanics. 3 Credit Hours.

Properties of fluids, gas systems, pressure distribution in static fluids, and hydrostatic forces on plane and curved surfaces are discussed. Kinematics and dynamics of fluid motion, dimensional analysis and similitude, flow in closed conduits, pumps, design of water distribution systems, and an introduction to flow in open channels is also included.

Prerequisite: CAE 210 and (PHY 222 or PHY 230).

Components: LEC.

Grading: GRD.

Typically Offered: Fall & Spring.

CET 340. Introduction to Environmental Engineering. 3 Credit Hours.

Environmental mass and energy balances, introduction to environmental chemistry, air pollution, water pollution, sustainable solid waste management, risk assessment, and global atmospheric change are discussed.

Prerequisites: MTH 162 or MTH 172, and CHM 121 or CHM 151.

Components: LEC.

Grading: GRD.

Typically Offered: Spring.

CET 345. Environmental Laboratory and Analysis. 3 Credit Hours.

Laboratory-based course focusing on the analysis of environmental samples including water, wastewater, air, and solids. Basic analytical techniques and quality control are also included as well as an introduction to advanced analytical measurements.

Prerequisite: CET 340 and (CHM 121 or CHM 151).

Components: LEC.

Grading: GRD.

Typically Offered: Fall.

CET 350. Chemical Reaction Engineering Kinetics. 3 Credit Hours.

Culmination of undergraduate courses in chemistry, material and energy balances, transport phenomena, numerical methods, and thermodynamics. Introduces the principles and calculation techniques used to analyze and design chemical reactors to produce petrochemicals, advanced materials, polymers, and biochemicals.

Prerequisite: CET 200.

Components: LEC.

Grading: GRD.

Typically Offered: Spring.

CET 351. Mass Transfer Operations. 3 Credit Hours.

Fundamentals of interphase mass transfer and transfer units, and design of differential mass transfer equipment, with special emphasis on absorption, stripping, humidification and drying.

CET 200 and MAE 303.

Components: LEC.

Grading: GRD.

Typically Offered: Fall.

CET 395. Undergraduate Research. 1-3 Credit Hours.

This course allows undergraduate students to engage in research (experimental and/or computational) dealing with an ongoing research topic in the environmental engineering field.

Components: RSC.

Grading: GRD.

Typically Offered: Fall, Spring, & Summer.

CET 403. Senior Design Project I - Engineering Design. 3 Credit Hours.

A two semester comprehensive design project applying the knowledge acquired during earlier coursework and implementing the pedagogy of life-long learning. Team projects incorporate interdisciplinary design skills, engineering standards and realistic constraints. The faculty coordinator working with practicing design professionals provide consultation, guidance and recommendations on aspects such as problem definition, evaluation of design alternatives and approaches. The course progresses along the customary design sequence of pre-design, schematic design and design development phases established in Civil, Architectural and Environmental Engineering practice.

Components: LEC.

Grading: GRD.

Typically Offered: Fall.

CET 404. Senior Design Project II – Integrated Engineering Documents. 3 Credit Hours.

The second semester of a two semester comprehensive design project applying the knowledge acquired during earlier coursework and implementing the pedagogy of life-long learning. Team projects incorporating interdisciplinary design skills, engineering standards and realistic constraints. The faculty coordinator working with several practicing design professionals provide consultation, guidance, and recommendations on aspects of preparing the construction documents required for project procurement and construction. Using the designs produced in CET 403 the course develops the drawings, specifications and calculations required for a comprehensive construction documents package.

Prerequisite: CET 403.

Components: LEC.

Grading: GRD.

Typically Offered: Spring.

CET 430. Water-Resources Engineering I. 3 Credit Hours.

Basic principles of open channel flow. Computation of water surface profiles. Design of hydraulic structures, design of lined and unlined open channels, and design of sanitary sewer systems. Introduction to hydrology and analysis of hydrologic data. Rainfall characteristics and peak runoff models.

Prerequisite: CET 330 or CAE 330.

Components: LEC.

Grading: GRD.

Typically Offered: Spring.

CET 440. Water Quality Control Systems. 3 Credit Hours.

Physical, Chemical and Biological Transformations; Water and Wastewater Treatment Processes; Water Treatment Plant Design; Wastewater Treatment Plant Design; Case Studies

Prerequisite: CET 330 or CAE 330 and CET 340.

Components: LEC.

Grading: GRD.

Typically Offered: Spring.

CET 450. Process Dynamics and Control. 3 Credit Hours.

Modeling, dynamics, and automatic control of chemical processes. Analysis of control system design performance and stability, feedback, and feedforward schemes. Computer implementation and laboratory applications.

CET 350 and CET 351.

Components: LEC.

Grading: GRD.

Typically Offered: Fall.

CET 455. Unit Operations Laboratory. 1 Credit Hour.

Operating and performance characteristics of process sensors, incompressible fluid flow, and thermodynamic systems. Documentation required to design and operate a chemical process safely, efficiently and profitably. Structure, analyze, design, and implement a closed-loop PID controllers.

CET 350 and CET 351.

Components: LEC.

Grading: GRD.

Typically Offered: Fall.

CET 530. Water Resources Engineering II. 3 Credit Hours.

Runoff models, routing models, water-quality models, and evapotranspiration models. Design of storm water management systems. Principles of groundwater flow. Design of wells and wellfields for public water supply. Legal regulatory, and economic components of water-resources management systems. Comprehensive design project.

Prerequisite: CET 430 or CAE 430 OR permission of instructor.

Components: LEC.

Grading: GRD.

Typically Offered: Fall.

CET 533. Water-Quality Control in Natural Systems. 3 Credit Hours.

Water quality regulations, fate and transport processes, water-quality control in rivers, lakes, wetlands, oceans, and ground water.

Pre or Corequisite: CET 430 and CET 440.

Components: LEC.

Grading: GRD.

Typically Offered: Offered by Announcement Only.

CET 540. Environmental Chemistry. 3 Credit Hours.

Kinetics, equilibrium, acid-base, oxidation-reduction, and reaction chemistry applied to water and wastewater engineering.

Prerequisite: CHM 121.

Components: LEC.

Grading: GRD.

Typically Offered: Offered by Announcement Only.

CET 541. Environmental Engineering Microbiology. 3 Credit Hours.

Classification of microorganisms. Microbial agents of infectious diseases and modes of disease transmission. Control of pathogens through water and waste treatment, food protection, and insect control. Microbial ecology and bioremediation systems. Laboratory exercises in microbiology.

Components: LEC.

Grading: GRD.

Typically Offered: Offered by Announcement Only.

CET 542. Solid and Hazardous Waste Engineering. 3 Credit Hours.

Solid-waste characteristics, recycling, incineration, hazardous waste characteristics, prevention, and physical and chemical treatment are covered. Design projects are also included.

Prerequisite: CET 340.

Components: LEC.

Grading: GRD.

Typically Offered: Offered by Announcement Only.

CET 543. Air Pollution Control Engineering. 3 Credit Hours.

Fundamentals of air pollution and air quality; properties and control of particulates, volatile organic compounds, carbon monoxide, sulfur oxides, and nitrogen oxides; motor vehicle emissions; health and aesthetic effects (acid rain, visibility), laws and regulations, meteorology and pollutant transport in the atmosphere; indoor air pollution.

Prerequisite: MAE 303 and (CET 330 or CAE 330 or MAE 309).

Components: LEC.

Grading: GRD.

Typically Offered: Offered by Announcement Only.

CET 544. Introduction to Atmospheric Chemistry. 3 Credit Hours.

This course covers the basic principles of atmospheric chemistry. Concepts taught will include gas phase reactions, the production and destruction of ozone, aerosol size and composition.

Senior Standing.

Components: LEC.

Grading: GRD.

Typically Offered: Spring.

CET 560. Aerosol Science and Technology. 3 Credit Hours.

This course will introduce key concepts of aerosol science and engineering and the fundamentals of particulate matter transport, formation and growth in environmental, energy and other engineered systems.

PHY 222.

Components: LEC.

Grading: GRD.

Typically Offered: Fall.

CET 570. Soft Matter & Colloids. 3 Credit Hours.

an introductory soft matter and colloids course with a particular emphasis on colloids, polymers, surfactant, emulsions, and gel/hydrogel-based technologies. The following topics as applied in an engineering context will be covered: polymer science fundamentals including various polymerization techniques, polymer solution and melt properties, polymer and colloidal gels/hydrogels, physico-chemical aspects of colloidal dispersions, emulsions, surfactants, advanced characterization including rheology and scattering. Applications aspects in a wide range of industries will additionally be covered.

Components: LEC.

Grading: GRD.

Typically Offered: Spring.

CET 571. Chemical Product Design. 3 Credit Hours.

This course is designed to develop the formulation design background required to design a range of different consumer and pharma products (skin care, haircare, make-up, foods, homecare, laundry, agro products, pharma etc) Understanding of component self-assembly and interaction effects between components in complex multicomponent mixtures and understanding of the impact of formulation conditions (pH, electrolyte, perfume etc) on the interactions and performance will be built during the course. Novel formulation tools and strategies such as AI/Machine Learning coupled with high throughput robotic platforms for developing formulation labs of the future will be discussed. Design of sustainable formulations will additionally be covered.

CET 570.

Components: LEC.

Grading: GRD.

Typically Offered: Spring.

CET 580. Affordable and Sustainable Batteries. 3 Credit Hours.

Basic thermodynamics and kinetics of electrochemical reactions with emphasis on the principle and performance of batteries. Foundations and applications of modern electrochemistry and rechargeable battery technologies (CHM 121 or CHM 151) and PHY 222.

Components: LEC.

Grading: GRD.

Typically Offered: Fall.

CET 590. Special Topics. 1-3 Credit Hours.

A course that does not have an established course number. Usually a one-time course offering or an experimental course prior to assigning a formal course number.

Components: LEC.

Grading: GRD.

Typically Offered: Fall, Spring, & Summer.

CET 595. Special Problems. 1-3 Credit Hours.

Project course introducing methods of research through an individual investigation of current problems. Offered by special arrangement only.

Components: RSC.

Grading: GRD.

Typically Offered: Fall, Spring, & Summer.

CET 605. Master's Project. 3 Credit Hours.

Project in Chemical, Environmental or Materials Engineering. Course is an option for the non-thesis master's student.

Components: IND.

Grading: GRD.

Typically Offered: Fall, Spring, & Summer.

CET 630. Water Resources Engineering II. 3 Credit Hours.

Runoff models, routing models, water-quality models, and evapotranspiration models. Design of storm water management systems. Principles of groundwater flow. Design of wells and wellfields for public water supply. Legal regulatory, and economic components of water-resources management systems. Comprehensive design project.

Prerequisite: CET 430 or CAE 430 OR permission of instructor.

Components: LEC.

Grading: GRD.

Typically Offered: Fall.

CET 633. Water-Quality Control in Natural Systems. 3 Credit Hours.

Water quality regulations, fate and transport processes, water-quality control in rivers, lakes, wetlands, oceans, and ground water.

Components: LEC.

Grading: GRD.

Typically Offered: Offered by Announcement Only.

CET 640. Environmental Chemistry. 3 Credit Hours.

Kinetics, equilibrium, acid-base, oxidation-reduction, and reaction chemistry applied to water and wastewater engineering.

Components: LEC.

Grading: GRD.

Typically Offered: Offered by Announcement Only.

CET 641. Environmental Engineering Microbiology. 3 Credit Hours.

Classification of microorganisms. Microbial agents of infectious diseases and modes of disease transmission. Control of pathogens through water and waste treatment, food protection, and insect control. Microbial ecology and bioremediation systems. Laboratory exercises in microbiology.

Components: LEC.

Grading: GRD.

Typically Offered: Offered by Announcement Only.

CET 642. Solid and Hazardous Waste Engineering. 3 Credit Hours.

Solid-waste characteristics, recycling, incineration, hazardous waste characteristics, prevention, and physical and chemical treatment are covered. Design projects are also included.

Components: LEC.

Grading: GRD.

Typically Offered: Offered by Announcement Only.

CET 643. Air Pollution Control Engineering. 3 Credit Hours.

Fundamentals of air pollution and air quality; properties and control of particulates, volatile organic compounds, carbon monoxide, sulfur oxides, and nitrogen oxides; motor vehicle emissions; health and aesthetic effects (acid rain, visibility), laws and regulations, meteorology and pollutant transport in the atmosphere; indoor air pollution.

Components: LEC.

Grading: GRD.

Typically Offered: Offered by Announcement Only.

CET 644. Introduction to Atmospheric Chemistry. 3 Credit Hours.

This course covers the basic principles of atmospheric chemistry. Concepts taught will include gas phase reactions, the production and destruction of ozone, aerosol size and composition.

Components: LEC.

Grading: GRD.

Typically Offered: Spring.

CET 660. Aerosol Science and Technology. 3 Credit Hours.

This course will introduce key concepts of aerosol science and engineering and the fundamentals of particulate matter transport, formation and growth in environmental, energy and other engineered systems.

Components: LEC.

Grading: GRD.

Typically Offered: Fall.

CET 670. Soft Matter & Colloids. 3 Credit Hours.

an introductory soft matter and colloids course with a particular emphasis on colloids, polymers, surfactant, emulsions, and gel/hydrogel-based technologies. The following topics as applied in an engineering context will be covered: polymer science fundamentals including various polymerization techniques, polymer solution and melt properties, polymer and colloidal gels/hydrogels, physico-chemical aspects of colloidal dispersions, emulsions, surfactants, advanced characterization including rheology and scattering. Applications aspects in a wide range of industries will additionally be covered.

Components: LEC.

Grading: GRD.

Typically Offered: Spring.

CET 671. Chemical Product Design. 3 Credit Hours.

This course is designed to develop the formulation design background required to design a range of different consumer and pharma products (skin care, haircare, make-up, foods, homecare, laundry, agro products, pharma etc) Understanding of component self-assembly and interaction effects between components in complex multicomponent mixtures and understanding of the impact of formulation conditions (pH, electrolyte, perfume etc) on the interactions and performance will be built during the course. Novel formulation tools and strategies such as AI/Machine Learning coupled with high throughput robotic platforms for developing formulation labs of the future will be discussed. Design of sustainable formulations will additionally be covered.

Components: LEC.

Grading: GRD.

Typically Offered: Fall.

CET 680. Affordable and Sustainable Batteries. 3 Credit Hours.

Basic thermodynamics and kinetics of electrochemical reactions with emphasis on the principle and performance of batteries. Foundations and applications of modern electrochemistry and rechargeable battery technologies

Components: LEC.

Grading: GRD.

Typically Offered: Fall.

CET 690. Special Topics. 1-3 Credit Hours.

Sub-titles describing the topics to be offered will be shown in parentheses in the printed class schedule, following the title Special Topics.

Components: LEC.

Grading: GRD.

Typically Offered: Offered by Announcement Only.

CET 695. Special Problems. 1-3 Credit Hours.

Project course introducing methods of research through an individual investigation of current problems. Offered by special arrangement only.

Components: RSC.

Grading: GRD.

Typically Offered: Offered by Announcement Only.

CET 703. Graduate Research Seminar. 1 Credit Hour.

Attendance and active participation in a designated semester seminar series.

Components: SEM.

Grading: SUS.

Typically Offered: Fall & Spring.

CET 704. Graduate Teaching. 1-3 Credit Hours.

Teaching or assisting in a course with a substantial level of instructional responsibility. Only open to doctoral students.

Components: LEC.

Grading: SUS.

Typically Offered: Fall & Spring.

CET 730. Advanced Fluid Mechanics. 3 Credit Hours.

Quantitative description of fluid flows including viscous flow, inviscid flow, turbulent flow, compressible flow, and geophysical flows. Transport of tracers. Basics of computational fluid dynamics.

Graduate standing (with a first course in fluid mechanics).

Components: LEC.

Grading: GRD.

Typically Offered: Offered by Announcement Only.

CET 735. Water and Wastewater Engineering: Treatment and Reuse. 3 Credit Hours.

Physical treatment processes; Chemical unit processes; Advanced biological treatment processes; Sludge treatment and disposal; Industrial water supply and wastewater treatment; Membrane systems for wastewater treatment and case studies; Advanced wastewater treatment and reuse; Environmental nanotechnology.

Components: LEC.

Grading: GRD.

Typically Offered: Offered by Announcement Only.

CET 743. Risk Analysis. 3 Credit Hours.

Probabilistic risk assessment, Poisson processes, Bayesian methods, fault trees, contaminant transport models, and dose-response relationships for assessment of natural and technological risks.

Components: LEC.

Grading: GRD.

Typically Offered: Offered by Announcement Only.

CET 750. Engineering Reaction Kinetics. 3 Credit Hours.

The theory and application of chemical reaction kinetics to the design of real chemical reactors, including: a - non-isothermal reactors: simultaneous solution of molar and energy balances, reactor stability and multiple steady states; b - non-ideal reactors: residence time distributions and reactor flow models; c - heterogeneous reactors: simultaneous mass transfer and reaction in porous catalysts, overall effectiveness factors. In addition, kinetics and reactor design in biochemical engineering, polymerization processes, and chemical vapor deposition processes will be introduced.

Components: LEC.

Grading: GRD.

Typically Offered: Fall.

CET 760. Aerosol Instrumentation. 3 Credit Hours.

This course will cover instruments used in aerosol and air quality research. The students are expected to learn the instruments' principal theory, operation, and applications. These instruments can measure the physiochemical and biological properties of the aerosols, including size, concentration, mass, optical properties, chemical composition, toxins, and biological components. We will also discuss methods to construct laboratory, ground and airborne sampling systems that measure aerosol properties representative to those in the ambient environment, where sampling loss can be minimized and quantified.

Components: LEC.

Grading: GRD.

Typically Offered: Spring.

CET 780. Indoor Environmental Modeling. 3 Credit Hours.

Prediction of indoor environment using computational fluid dynamics techniques. Advanced topics in thermal comfort and indoor air quality. Basic concepts of turbulence modeling and numerical methods for natural, forced, and mixed convection and jet flows indoors. Simulation of air velocity, temperature, and contaminant concentrations in buildings. Comparison of the simulated results with measured data.

Components: LEC.

Grading: GRD.

Typically Offered: Offered by Announcement Only.

CET 790. Advanced Topics. 1-3 Credit Hours.

Subject matter offerings based upon student demand and availability of faculty. Subtitles describing the topics to be offered will be shown in parentheses in the printed class schedule, following the title Advanced Topics.

Components: LEC.

Grading: GRD.

Typically Offered: Offered by Announcement Only.

CET 795. Special Problems. 1-3 Credit Hours.

Research and/or design projects. Individual investigation of current problems. Offered by special arrangement only.

Components: RSC.

Grading: GRD.

Typically Offered: Offered by Announcement Only.

CET 810. Master's Thesis. 1-6 Credit Hours.

The student working on his/her Master's thesis enrolls for credit as determined by his/her advisor. Credit is not awarded until the thesis has been accepted.

Components: THI.

Grading: SUS.

Typically Offered: Fall, Spring, & Summer.

CET 820. Research in Residence - MS. 1-6 Credit Hours.

Used to establish research in residence for the thesis for the Master's degree after the student has enrolled for the permissible cumulative total in CET 810. Credit not granted. May be regarded as full-time residence.

Components: THI.

Grading: SUS.

Typically Offered: Fall, Spring, & Summer.

CET 825. Continuous Registration - Master's Study. 1 Credit Hour.

To establish residence for non-thesis master's students who are preparing for major examinations. Credit not granted. Regarded as full time residence.

Components: THI.

Grading: SUS.

Typically Offered: Fall, Spring, & Summer.

CET 830. Pre-Candidacy Doctoral Dissertation. 1-12 Credit Hours.

Doctoral dissertation credits taken prior to the Ph.D. student's candidacy. The student will enroll for credit as determined by his/her advisor. Not more than 12 credit hours of CET 830 may be taken in a regular semester, nor more than 6 credit hours in a summer session.

Components: THE.

Grading: SUS.

Typically Offered: Fall, Spring, & Summer.

CET 840. Post-Candidacy Doctoral Dissertation. 1-12 Credit Hours.

Doctoral dissertation credits taken after the Ph.D. student has been admitted to candidacy. The student will enroll for credit as determined by his/her advisor. Not more than 12 credit hours in CET 840 may be taken in a regular semester, nor more than 6 credits in a summer session.

Components: THE.

Grading: SUS.

Typically Offered: Fall, Spring, & Summer.

CET 850. Research in Residence. 1 Credit Hour.

Used to establish research in residence for the Ph.D. after the student has been enrolled for the permissible cumulative total in appropriate doctoral research. Credit not granted. May be regarded as full-time residence as determined by the Dean of the Graduate School.

Components: THE.

Grading: SUS.

Typically Offered: Fall, Spring, & Summer.