

# Civil, Materials, and Environmental Engineering (CME)

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## **CME 111. The Art of Structural Form. 3 hours.**

Examination of aesthetic, economic, and structural considerations of engineered structures since the start of the industrial revolution. Analysis of different design choices of bridges, tall buildings, thin shell, and other structures. Course Information: Field trips required at a nominal fee. *Creative Arts course.*

## **CME 112. Evolution of Infrastructure and Society. 3 hours.**

Evolution of infrastructure and its interaction with US society. Examples include development of transportation systems, water infrastructure, electrical grid, structural and geotechnical technology. Ethical and societal implications of new systems. Course Information: Field trips required at a nominal fee. Prerequisite(s): ENGL 160; or consent of the instructor. *US Society course.*

## **CME 119. Introduction to Environmental Engineering and Science. 3 hours.**

Pollution and the environment. Impact of human economic activity on the environment. Principles of environmental engineering and science with application to natural and engineered environmental systems. Course Information: Prerequisite(s): Consent of the instructor.

## **CME 197. Introduction to Civil and Environmental Engineering. 0 hours.**

Introduction to careers in civil and environmental engineering, introduction to business practice in civil and environmental engineering, professional ethics and challenges currently faced by the civil and environmental engineering profession. Course Information: Satisfactory/Unsatisfactory grading only. All CME freshmen and transfer students will be required to take course during the first year of enrollment at UIC.

## **CME 201. Statics. 3 hours.**

Analysis of forces, equilibrium of two- and three-dimensional structures, frames and machines. Friction, centroids, virtual work and energy. Course Information: Prerequisite(s): MATH 181 and PHYS 141.

## **CME 203. Strength of Materials. 3 hours.**

Relationships between the stresses and strains within a deformable body. Axially loaded members, torsion and the bending of bars. Stress transformation equations. Column theory. Course Information: Prerequisite(s): CME 201.

## **CME 205. Structural Analysis I. 3 hours.**

Analysis of trusses, beams and frames. Classical methods and analysis with microcomputers. Displacements, shear and bending moments, influence lines. Course Information: Prerequisite(s): CME 203.

## **CME 207. Engineering Probability and Economics. 3 hours.**

Principles of probability in civil and environmental engineering; theories and principles of economics in civil and environmental engineering; managerial decision making techniques for design and construction of projects. Course Information: Prerequisite(s): MATH 181.

## **CME 211. Fluid Mechanics and Hydraulics. 3 hours.**

Covers the basic fluid mechanics topics of statics and kinematics, with emphasis on civil engineering aspects of open channel hydraulics and pipe flow. Course Information: Prerequisite(s): CME 201. Class Schedule Information: To be properly registered, students must enroll in one Laboratory and one Lecture.

## **CME 215. Hydraulics and Hydrology. 3 hours.**

Hydraulics of pipe flow, open channel flow and hydraulic machinery. Ground water and surface water hydrology. Course Information: Prerequisite(s): ME 211. Class Schedule Information: To be properly registered, students must enroll in one Laboratory-Discussion and one Lecture-Discussion.

## **CME 260. Properties of Materials. 3 hours.**

Introduction to the relationships between composition and microstructure; correlation with physical and mechanical behavior of metals, ceramics, and polymers. Manufacturing methods. Service performance. Materials selection. Course Information: Credit is not given for CME 260 if the student has credit for CME 261 or ME 261. Prerequisite(s): CHEM 122 and CHEM 123 and PHYS 141 and MATH 181.

## **CME 261. Materials for Manufacturing. 2 hours.**

Introductory-level course in materials engineering to familiarize students with relationships between processing, structure and properties of materials used to manufacture devices. Course Information: Same as ME 261. Credit is not given for CME 261 if the student has credit for CME 260. Prerequisite(s): CHEM 122 and CHEM 123 and PHYS 141 and MATH 181.

## **CME 290. Engineering Surveying. 1 hour.**

Theory and practice of fundamentals of horizontal and vertical measurement of distances, angles and directions, leveling, traverses, topography, road and curve field layout, control and construction surveys, coordinate systems, GPS and Map Production. Course Information: Prerequisite(s): MATH 181; or consent of the instructor. Class Schedule Information: To be properly registered, students must enroll in one Lecture-Discussion and one Discussion and one Laboratory.

## **CME 297. Civil and Environmental Engineering Drawing and Design. 3 hours.**

Manual and computer-aided drawing and drafting principles for civil and environmental engineering practice. Application of building information modeling in civil and environmental engineering professional practice. Course Information: Prerequisite(s): Eligibility to register for ENGL 160. Interested students not enrolled in a degree program in the College of Engineering shall obtain permission from the instructor.

## **CME 300. Composition and Properties of Concrete. 2 hours.**

Properties and types of cements and aggregates, hydration, mix design, properties of fresh and hardened concrete. Course Information: Prerequisite(s): Credit or concurrent registration in CME 203. Class Schedule Information: To be properly registered, students must enroll in one Discussion/Recitation and one Laboratory.

## **CME 301. Behavior and Design of Metal Structures. 3 hours.**

Design of metal structures, behavior of members and their connections, theoretical, experimental and practical basis for proportioning members. Course Information: Prerequisite(s): CME 205.

## **CME 302. Transportation Engineering. 3 hours.**

Fundamentals of transportation engineering. Design, operations and planning of transportation systems of various technologies, emphasizing road and public transit. Course Information: Extensive computer use required. Field trips and computer laboratory required. Prerequisite(s): MATH 210; or consent of the instructor. Class Schedule Information: To be properly registered, students must enroll in one Laboratory and one Lecture-Discussion.

**CME 310. Design of Reinforced Concrete Structures. 3 hours.**

Analysis and design of reinforced concrete structural elements: beams, slabs, columns, and foundations. Use of current ACI 318 building code. Course Information: Prerequisite(s): CME 205 and credit or concurrent registration in CME 300.

**CME 311. Water Resources Engineering. 3 hours.**

Principles of water-resources engineering including hydrologic processes and frequency analysis; fluids mechanics applied to closed conduits and open channels; groundwater engineering; urban water distribution. Laboratory experiments. Course Information: Extensive computer use required. Prerequisite(s): CME 211. Class Schedule Information: To be properly registered, students must enroll in one Laboratory and one Lecture-Discussion.

**CME 315. Soil Mechanics and Laboratory. 4 hours.**

Soil formation, phase relationships, index properties and soil classification, soil composition, soil compaction, water in soils, stresses in soils, consolidation, shear strength, soils laboratory. Course Information: Prerequisite(s): CME 203 and CME 211. Class Schedule Information: To be properly registered, students must enroll in one Laboratory-Discussion and one Lecture-Discussion.

**CME 322. Environmental Engineering. 3 hours.**

Environmental engineering and design for water and waste problems. Interactive effects of man-made projects on resources and the environment. Course Information: Previously listed as CME 216. Prerequisite(s): CHEM 122; and Credit or concurrent registration in CME 211. Class Schedule Information: To be properly registered, students must enroll in one Laboratory-Discussion and one Lecture-Discussion.

**CME 359. Mechanical Vibrations. 3 hours.**

Free and forced vibrations of damped linear single and multiple degree of freedom systems. Approximate methods, instrumentation, and applications. Course Information: Same as ME 308. Prerequisite(s): CS 109; and ME 210; and MATH 220.

**CME 391. Civil and Materials Engineering Practicum. 1 hour.**

Provides students with the opportunity to apply the skills and knowledge gained in previous engineering courses within a professional, working environment. Course Information: Satisfactory/Unsatisfactory grading only. May be repeated. A maximum of 1 hour awarded toward degree requirements. Prerequisite(s): Approval of the Department.

**CME 392. Undergraduate Research. 1-3 hours.**

Research and indepth study of a subject of interest under the close supervision of a faculty member. A report is required. Course Information: Prerequisite(s): Senior standing.

**CME 394. Undergraduate Seminar. 1-3 hours.**

Students conduct an indepth study of areas of engineering of special interest to them which will be presented to the class in a seminar format. Course Information: Prerequisite(s): Senior standing.

**CME 396. Civil Engineering Systems Design. 2 or 3 hours.**

Introduction to design process and methodologies. Aspects of civil engineering project management and the deterministic and probabilistic design methods. Professional Verbal and Written Communication. Preparation of senior design projects. Course Information: Prerequisite(s): Students who will be graduating any time during the next calendar year are eligible to enroll.

**CME 400. Advanced Design of Reinforced Concrete Structures. 3 or 4 hours.**

Design of reinforced concrete building structures, including design for lateral loads due to wind, structural systems for reinforced concrete buildings, shear walls, and design for seismic forces. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): CME 310 or the equivalent.

**CME 401. Advanced Design of Metal Structures. 3 or 4 hours.**

Plate girders; unsymmetrical bending; torsion of thin-walled structures; lateral-torsional instability; composite construction. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): CME 301.

**CME 402. Geometric Design of Highway Facilities. 3 or 4 hours.**

Elements of geometric design. Driver, vehicle and roadway system characteristics. Horizontal and vertical alignment design. Intersection design and operation. Capacity and level of service. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): CME 302; and CME 297 or ME 250; or consent of the instructor.

**CME 403. Hydraulic Design. 3 or 4 hours.**

Groundwater hydraulics, movement, recharge and well design; migration and drainage; design of dams, spillways and turbines; wave and coastal engineering design. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): CME 311.

**CME 404. Railroad Track Engineering. 3 hours.**

Railroad track engineering concepts including track components, response of track to wheel loads, design and analysis of railroad tracks, construction, evaluation, and maintenance of railroad tracks, load distribution, and track substructures. Course Information: Prerequisite(s): CME 315; or consent of the instructor. Recommended Background: Basic knowledge of strength of materials, soil mechanics, and structures.

**CME 405. Foundation Analysis and Design. 3-4 hours.**

Site characterization; analysis and design of shallow foundations, deep foundations and earth retaining structures; foundations on difficult soils; effects of construction; instrumentation and monitoring. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): CME 315.

**CME 406. Bridge Design I. 3 or 4 hours.**

Theory and design procedures related to the analysis and design of modern bridges. Using the AASHTO Code, includes concrete and steel structures, construction practices and procedures. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): CME 301 and CME 310.

**CME 407. Soil and Site Improvement Methods. 3 or 4 hours.**

Compaction, preloading, vertical drains, grouting, admixture stabilization, thermal stabilization, soil reinforcement, geosynthetics; construction of embankments on soft clay, embankments on mechanically stabilized earth walls, hydraulic barriers; case studies. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): CME 315.

**CME 408. Traffic Engineering and Design. 3 or 4 hours.**

Highway Traffic control with an emphasis on highway capacity analysis and Traffic Signal Design. Queuing theory, traffic flow theory, corridor management, and Traffic Safety. Course Information: 3 undergraduate hours. 4 graduate hours. Extensive computer use required. Field work required. Prerequisite(s): CME 302 or consent of the instructor.

**CME 409. Structural Analysis II. 3 or 4 hours.**

Approximate analysis of structures including trusses and multistory frames. Influence lines, cables and arches. Principles of limit analysis for structures and structural elements. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): CME 205 or consent of the instructor.

**CME 410. Design of Prestressed Concrete Structures. 3 or 4 hours.**

Principles of prestressed concrete. Analysis and design of statically determinate prestressed concrete members. Introduction to design and detailing of connections. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): CME 310.

**CME 411. Chemistry for Environmental Professionals. 3 hours.**

Introductory atmospheric chemistry, aspects of air pollution, chemistry related to natural water and water treatment; priority organic pollutants and heavy metals. Course Information: Same as EOHS 440. Prerequisite(s): One year of college chemistry.

**CME 413. Design of Wood Structures. 3 or 4 hours.**

Covers the properties and behavior of wood as a structural material; the focus will be on the analysis of structural wood elements. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): CME 301; or CME 310; or consent of the instructor.

**CME 414. Design of Masonry Structures. 3 or 4 hours.**

Material characteristics of masonry as an engineering material, design of masonry members subjected to axial loads, bending, combined axial and bending loads, design of masonry shear walls, and design of multi-story masonry buildings. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): CME 301; or CME 310; or consent of the instructor.

**CME 415. Environmental Geotechnology. 3 or 4 hours.**

Environmental laws and regulations, sources and types of waste materials, waste materials in geotechnical engineering applications, geotechnical management of municipal, industrial, mine and nuclear wastes. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): CME 315.

**CME 419. Structural Loads Determination. 3 or 4 hours.**

Loads applied to buildings and other structures. Live and dead loads. Snow, wind, earthquake and flood loads. Historical overview of loading standards and current loading standards. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): CME 205; or consent of the instructor.

**CME 420. Water and Wastewater Analysis Laboratory. 0-4 hours.**

Laboratory class for environmental engineering. Analysis of water, wastewater and soil for nutrients, pollutants, physical parameters and biological parameters. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): CME 216; or graduate standing. Class Schedule Information: To be properly registered, students must enroll in one Laboratory-Discussion and one Lecture-Discussion.

**CME 421. Water Treatment Design. 3 or 4 hours.**

Water quality control systems. Physical-chemical unit processes applied to systems designed for treatment of municipal and industrial waters. Course Information: 3 undergraduate hours. 4 graduate hours. Field trip required at nominal fee. Prerequisite(s): CME 322. Students in programs outside stated restrictions may be admitted with the consent of the instructor.

**CME 422. Wastewater Treatment Design. 3 or 4 hours.**

Processes involved in the biological treatment of wastewater. Aerobic and anaerobic treatment, sludge stabilization, and nutrient removal. Course Information: 3 undergraduate hours. 4 graduate hours. Field trip required. Prerequisite(s): CME 322 or the equivalent.

**CME 423. Management of Solid and Hazardous Wastes. 3 hours.**

Management of solid and hazardous waste, including radioactive waste: landfills, incineration, recycling, composting, source reduction, groundwater and air pollution impacts, control, regulations, siting, health impacts. Course Information: Same as EOHS 472, and GEOG 444.

**CME 425. Environmental Remediation Engineering. 3 or 4 hours.**

Sources of contamination, regulations, site characterization, impact assessment, waste disposal and containment options, waste treatment options, case studies. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): CME 315.

**CME 427. Engineering Hydrology. 3 or 4 hours.**

Processes, techniques and concepts in hydrology of interest to the engineer: precipitation, interception, evaporation, groundwater, unit hydrographs, flood routing, and statistics. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): CME 211 and senior standing.

**CME 430. Theory of Elasticity I. 3 or 4 hours.**

The boundary value problems of linear elasticity. Uniqueness of solution. Reduction to two dimensions: the plane problems, torsion, bending. Polar coordinates and general orthogonal coordinates. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): CME 205 and Math 220; or the equivalents.

**CME 431. Introduction to Continuum Mechanics. 3 or 4 hours.**

Vectors and tensors, stress, principal stresses and principal axes, deformation, compatibility conditions, constitutive equations, isotropy and mechanical properties of fluids and solids. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): CME 203 and CME 211; or CME 203 and ME 211.

**CME 432. Energy Methods in Mechanics. 3 or 4 hours.**

Variational theorems of elasticity. Applications to establish approximate systems and their solution. Beams (including shear deformation.) Introduction to instability theory. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): CME 205.

**CME 433. Fracture Mechanics and Failure Analysis I. 3 or 4 hours.**

Classical theory of strength of materials. Fracture mechanisms maps. Continuum damage mechanics. Introduction to fracture mechanics. Singular problems of elasticity. Stress intensity. Energy release rates. Irwin-Orowan, Barenblatt-Dugdale theories. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): CME 430.

**CME 434. Finite Element Analysis I. 3 or 4 hours.**

Establishment of basic finite element, matrix relations for one-dimensional heat conduction problems: Truss, beam and frame structural systems. Solution methods of the resulting equations. Introduction to two-dimensional analysis. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): CS 109; and CME 205 or ME 347.

**CME 435. Theory of Vibrations I. 3 or 4 hours.**

Analytical and numerical treatment of linear, discrete systems. Nonlinear discrete systems. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): CME 200 or the equivalent and MATH 220.

**CME 440. Cities and Sustainable Infrastructure. 0-4 hours.**

Integrated urban infrastructure planning based on sustainability and resilience; energy, water and transportation systems; design of green buildings; urban network design; methods of environmental assessment and infrastructure economics. Course Information: 3 undergraduate hours; 4 graduate hours. Prerequisite(s): CME 302 and CME 311; or consent of the instructor For graduate students: consent of instructor. Class Schedule Information: To be properly registered, students must enroll in one Lecture-Discussion and one Laboratory-Discussion.

**CME 441. City Logistics. 3 or 4 hours.**

Understanding the basics of the logistics planning, operation, and design for cities and urban environment in regard to people, goods and freight, and sustainability and the environment. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): CME 302; or consent of the instructor.

**CME 450. Probability and Reliability in Structural Design. 3 or 4 hours.**

Maximum uncertainty principle and probability distributions of random variables. Distributions of extremes and their applications. Statistics of failure. The weakest link theory. Time to failure. Structural reliability. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): Consent of the instructor.

**CME 453. Experimental Stress Analysis. 0-4 hours.**

Structural similitude and dimensional analysis. Strain measurement techniques. Introduction to photoelasticity. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): CME 430. Class Schedule Information: To be properly registered, students must enroll in one Laboratory and one Lecture.

**CME 454. Structural Analysis and Design of Tall Buildings. 3 or 4 hours.**

State-of-the-art introduction to structural analysis and design of tall buildings. Load impact on different structural systems. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): CME 401 or CME 409 or the equivalent, or consent of the instructor. Recommended background: Major structural analysis and design courses.

**CME 460. Crystallography and X-Ray Diffraction. 4 hours.**

Fundamentals of crystallography. Theory of x-ray diffraction, experimental methods and applications. Course Information: Prerequisite(s): CME 260. Class Schedule Information: To be properly registered, students must enroll in one Laboratory and one Lecture-Discussion.

**CME 470. Physical and Mechanical Properties of Materials. 4 hours.**

Basic metallurgical phenomena; kinetics and phase stability; diffusion and transformation rates. Mechanical properties of materials; creep; fatigue and fracture. Course Information: Prerequisite(s): CME 260. Class Schedule Information: To be properly registered, students must enroll in one Laboratory and one Lecture-Discussion.

**CME 471. Thermodynamics of Materials. 0-4 hours.**

Application of chemical and thermodynamic principles to processing and characterization of materials. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): CME 260. Class Schedule Information: To be properly registered, students must enroll in one Laboratory and one Lecture-Discussion.

**CME 480. Welding Metallurgy. 4 hours.**

Metallurgy of metals joining processes. Selection of processes and design of products manufactured by joining processes. Course Information: Prerequisite(s): CME 260. Class Schedule Information: To be properly registered, students must enroll in one Laboratory and one Lecture-Discussion.

**CME 481. Risk Management and Decision-Making in Construction. 3 or 4 hours.**

Application of decision analysis, optimization, and risk management tools in construction engineering and management, selection of contractors, site layout planning, quantifying impact of weather, change orders, resource utilization, optimal planning. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): Senior standing or above.

**CME 485. Construction Engineering and Management. 3 or 4 hours.**

Overview of construction engineering and project management. Construction industry, project cycles, contract administration, financing, legal management structures. Resource management; planning, quality control, productivity and safety. Course Information: 3 undergraduate hours. 4 graduate hours. Non-COE students shall obtain permission from the instructor prior to enrolling in the course.

**CME 486. Construction Equipment and Design Methods. 3 or 4 hours.**

Overview of the equipment and machinery that is used in construction engineering; Calculating Cycle Times, Production Rates and Cost; Earthwork Estimations; Construction Methods and Design. Course Information: 3 undergraduate hours. 4 graduate hours. Other non-COE students shall obtain permission from the instructor prior to enrolling in the course.

**CME 487. Construction Accounting and Financial Management. 3 or 4 hours.**

Accounting fundamentals and financial business management in construction engineering and management. The organizational management in civil infrastructure engineering, and project financial management, strategic management of civil environmental engineering enterprise. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): Senior standing or above.

**CME 488. Sustainable Construction. 3 or 4 hours.**

Coverage of construction methods and techniques that employ the principles of sustainable development. Materials and methods of construction, infrastructure planning and development, and environmental implications of construction activities. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): Senior standing or above.

**CME 490. Undergraduate Senior Design Thesis I. 0-8 hours.**

Introduction to engineering design and research methods: design tools, product conception and development, simulation, optimization, technical reports and presentations, literature survey and undergraduate thesis. Course Information: Credit only given to non-degree students. No graduation credit given to students enrolled in Engineering. Extensive computer use required. Prerequisite(s): Consent of the instructor.

**CME 491. Undergraduate Senior Design Thesis II. 0-8 hours.**

Introduction to engineering design and research methods: design tools, product conception and development, simulation, optimization, technical reports and presentations, literature survey and undergraduate thesis. Course Information: Extensive computer use required. Prerequisite(s): Consent of the instructor.

**CME 493. Seminar. 1-3 hours.**

Topics of mutual interest to a faculty and a group of students. Offered as announced in the Timetable.

**CME 494. Special Topics in Civil and Materials Engineering. 1-4 hours.**

Subject matter varies from section to section and from semester to semester, depending on the specialities of the instructor. Course Information: May be repeated. Students may register in more than one section per term. Prerequisite(s): Consent of the instructor.

**CME 496. Special Problems. 1-4 hours.**

Special problems or reading by special arrangement with a faculty member. Course Information: Prerequisite(s): Consent of the instructor.

**CME 497. Capstone Design. 2 or 3 hours.**

Application of principles of engineering and design methods to the solution of a large-scale design program. Communicating design solutions through verbal and written media. Course Information: Previously listed as CME 397. Prerequisite(s): CME 396 CME 396 and at least three courses from the following list: CME 301, CME 302, CME 310, CME 311, CME 315, CME 322.