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<td>Fate &amp; Transport of Toxics in the Environment (4 credits)</td>
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**CE 479/579 Fate & Transport of Toxics in the Environment (4 credits)**

Chemical, physical, and biological principles that govern the behavior of toxic materials such as heavy metals and synthetic organic compounds in the environment. Course emphasizes practical ways to represent chemical processes in models of pollutant behavior. Topics include: adsorption of pollutants on soils and sediments; transport across sediment-water and air-water interfaces; bioamplification of pollutants; multiphase fugacity models of organics; case studies of contaminated surface water, sediment and groundwater. This course is the same as ESM 479 and may be taken only once for credit.

**Prerequisites:** Senior or Graduate in CEE

**CE 483/583 Estuarine Circulation (4 credits)**

Introduction to the physical processes that govern estuarine and buoyant plume circulation. These include tides, density-driven circulation, internal tidal asymmetry and frontal propagation. Expected preparation: CE 576.

**Prerequisites:** CE 361 and CE 371; Graduate Standing

**CE 486/586 Environmental Chemistry (4 credits)**

Survey of chemical aspects of major environmental issues: stratospheric ozone holes and chlorofluorocarbons; air pollution; global climate change; fossil fuel energy/"carbon footprint"; renewable energy; nuclear energy/radioactivity; toxic chemicals (pesticides, PCBs); endocrine disruptors; surfactants, chemical dispersants/oil spills; biodegradability of chemicals; chemistry of natural waters/acid rain; toxic heavy metals. This is the same course as Ch 486 and can be taken only once for credit

**Prerequisites:** Ch 334 or 331; or CE 371.

**CE 469/569 Subsurface Hydrology (4 credits)**

Basic principles of aqueous flow in the subsurface, emphasizing the importance of groundwater as a resource. Hydrologic cycle, history of groundwater usage, aquifer classification and properties, Darcy’s experiments and Law, hydraulic head and potential, porosity and permeability, transmissivity and storativity, heterogeneity and anisotropy, saturated vs. unsaturated subsurface flow, and hydraulics of pumping wells (drawdown, flow in confined and unconfined aquifers, steady-state vs. transient flow, slug tests, and aquifer-test design).

**Prerequisite:** Senior or Graduate in CEE
CE 416/516 SEM: Forensic Structural Engineering (2 credits) Franz Rad
Application of engineering principles to investigate failures and performance problems of structures; case studies and examples of actual structural failures.
**Prerequisites:** knowledge of reinforced concrete (CE 434 or equivalent), steel (CE 432 or equivalent), and timber structures (CE 417 or equivalent) or graduate standing

CE 434 Principles of Reinforced Concrete (4 credits) Evan Kristof
Loads, load factors and structural safety, ultimate strength analysis; short column behavior, design of simple and continuous beams; one-way slabs; serviceability and detailing requirements with reference to current codes. **Prerequisite:** CE 321 and CE 325

CE 436/536 Masonry Design (3 credits) Steve Hawk
Materials of construction; design of masonry elements, lateral load resisting systems, and connections with reference to current codes. **Prerequisite:** CE 434 or graduate standing

CE 534/634 Advanced Reinforced Concrete Design (3 credits) Franz Rad
Design of spandrel beams, slabs on beams, shear walls, deep beams, corbels, and other components of reinforced concrete structures with reference to current codes. **Prerequisite:** CE 435 or graduate standing

CE 537/637 Earthquake Engineering (4 credits) Peter Dusicka
Response of structures to ground motions; determination and use of response spectra; seismic design criteria and provisions for buildings and other structures; and review of current practices for earthquake resistant design. **Prerequisite:** CE 529/629

CE 510/610 Advanced Geotech Earthquake Engineering (4 credits) Arash Khosravifar
This course introduces advanced concepts in geotechnical earthquake engineering. Topics include soil dynamics, developing ground motions for dynamic analysis, site-response analysis, soil-structure-interaction, liquefaction triggering analysis using in-situ SPT- and CPT-based methods, seismic slope stability analysis. **Prerequisite:** CE 443 or CE 543

CE 510/610 Advanced Soil Mechanics (4 credits) Diane Moug
This course builds on concepts introduced in CE 541. Topics include characterizing geotechnical properties with sampling and lab testing, and geotechnical characterization of soil with in-situ testing. Students will be expected to perform consolidation testing and direct simple shear testing in the geotechnical soils lab, and to interpret and present the results. **Prerequisite:** CE 541 or 641.

CE 493/593 Design & Operation of Bicycle and Ped Infra (4 credits) Chris Monsere
Design and operational concepts in the engineering design of bicycle and pedestrian infrastructure. Course covers on-road and shared path locations. Specific topics include design details of bikeways, basic geometric design, intersection and signalization considerations, and ADA requirements supporting non-motorized modes. **Prerequisite:** CE 351 or graduate standing

**When To Register**
- **Graduates:** February 17
- **Seniors:** February 19
- **Post-bacs:** February 24
- **Juniors:** February 26
- **Sophomores:** March 2
- **Freshmen:** March 4
- **Non-Degree:** March 9