Master of Civil Engineering

Program Overview

Program Director: Thomas J. Descoteaux

Medicine, law, architecture, accounting, pharmacy – all professions that require education in excess of four years, whether by a separate “Professional School” or by simply requiring more than four years to obtain an undergraduate degree. Much discussion has occurred lately in the engineering community concerning the “status” of the profession in the eyes of the public. Concerns over compensation, loss of respect from society in general, and the increasing trend toward viewing engineers as a commodity instead of as valued and skilled professionals has prompted some to take a hard look at the current educational system. Many engineers agree that, in light of the explosive growth of technology, the steady decrease in the number of credits required for an undergraduate engineering degree (from an average of 150 semester hours in 1950 to 133 today), and the loss of influence and control in the worlds of finance and politics (both critical to successfully solving the world’s problems through engineering), the skill set provided by a four year education is no longer adequate.

In light of these problems, the Board of Directors of the American Society of Civil
Engineers unanimously adopted Policy 465 in 2001:

“The American Society of Civil Engineers (ASCE) supports the concept of the Master’s degree or Equivalent as a prerequisite for licensure and the practice of civil engineering at a professional level."

ASCE encourages institutions of higher education, governmental units, employers, civil engineers, and other appropriate organizations to endorse, support, and promote the concept of mandatory post-baccalaureate education for the practice of civil engineering at a professional level. The implementation of this effort should occur through establishing appropriate curricula in the formal education experience, appropriate recognition and compensation in the workplace, and congruent standards for licensure.”

Norwich University saw ASCE’s Policy 465 as an opportunity to create a graduate program unlike any other. The Master of Civil Engineering program stresses the fundamental skills needed for success by tomorrow’s civil engineer. These skills include not only technical competency in your field of expertise but also the broad range of communication and management skills needed in the highly entrepreneurial business environment that comprises our profession.

Curriculum Map

Semester 1	Credits	Semester 2	Credits	Semester 3	Credits
GB 544 Project Management Techniques, Tools and Practices	6	Select one concentration course	6	Select one concentration course	6
EG 501 Engineering Mathematics	6	Select one concentration course	6	CE 561 Capstone Design Project	6
				CE 595 Residency[1]	0
	12		**12**		**12**

Total Credits: 36

1 Students are required to attend a one-week, on campus Residency Conference the June following or concurrent with their final course.

Curriculum Requirements

The 18-month Master of Civil Engineering program is divided into six, eleven-week, six-credit courses. There are also prerequisite courses available for those not meeting the admissions requirements with respect to coursework. Three courses comprise the program “core” and are required of all Master of Civil Engineering students. For the other three courses students choose from four available concentrations: structural engineering, environmental/water resources engineering, geotechnical engineering, or construction management.

Pre-requisite Courses

(If needed per admission committee assessment)		
CE 501	Hydraulics for Environmental Engineers	3
CE 503	Fundamentals of Soil Mechanics and Foundation Engineering	6
CE 505	Engineering Analysis Techniques	3
CE 506	Engineering Mechanics I	3
CE 507	Fundamentals of Structural Engineering	6
CE 509	Fundamentals of Environmental/Water Resources Engineering	6
CE 571	Elementary Geotechnical Tools Laboratory	1
GB 501	Fundamentals of Business Management	6
GB 502	Quantitative Methods and Financial Analysis for Managers	6

Core Courses (18 Credits)

GB 544	Project Management Techniques, Tools and Practices	6
EG 501	Engineering Mathematics	6
CE 561	Capstone Design Project	6

Culminating Academic Requirement

CE 595	Residency	0
Total Credits		18

Concentration Courses (18-19 Credits)

Environmental/Water Resources Concentration (18 credits)

CE 525	Physiochemical & Biological Processes in Water & Wastewater Treatment	6
CE 535	Stormwater Management and GIS Applications for Water Resources	6
CE 555	Geoenvironmental Engineering - Groundwater Flow and Waste Containment	6
Total Credits		18

Structural Concentration (18 credits)

CE 528	Classical, Matrix, and Dynamic Analysis of Structures	6
CE 538	Design of Steel and Timber Structures	6
CE 558	Design of Reinforced and Prestressed/Precast Concrete Structures	6
Total Credits		18

Geotechnical Concentration (19 credits)

CE 523	Intermediate Soil Mechanics and Foundation Engineering	6
CE 533	Earthquake Engineering and Soil Stabilization	6
CE 553	Computer Modeling in Geotechnical Engineering and Geotechnical Engineering Case Histories	6
CE 572	Intermediate Geotechincal Tools Laboratory	1
Total Credits		19

Construction Management Concentration (18 credits)

CE 529	Information Technology	6
CE 539	Contracts and Insurance	6
CE 559	Project Finance and Accounting	6
Total Credits		18

One-Week Residency

During the final phase of the Master of Civil Engineering program students are required to attend a one-week residency on the Norwich University campus. During this residency, students may attend professional presentations, participate in roundtable discussions with faculty, and present capstone design projects. The one-week residency is a degree requirement.

Faculty Member	Institution at which highest degree was earned
Thomas Descoteaux, PhD, PE (Program Director)	University of Connecticut
William Barry, PhD	Carnegie Mellon University
Michael S. Blount, MS, PE	Georgia Institute of Technology
Matthew Bovee, PhD	University of Kansas
Arif Cekic, PhD, PE	Wayne State University
Kenneth Edwards, PhD, PE	Iowa State University
Andrew Ernest, PhD, PE	Texas A&M
Thaddeaus Gabryszewski, MCE, PE	Norwich University
Kenneth Lamb, PhD, PE	University of Nevada – Las Vegas
Roger Lautzenheiser, PhD	Indiana University
W. Nicholas Marianos, PhD, PE	Tulane University
Joseph Miller, PhD, PE	Michigan Technological University
M. Catalina Orozco, PhD, PE	Georgia Institute of Technology
Bryan Pascarella, MBA	University of Pittsburgh
Michael Puddicombe, DBA	Boston University
Linda Ratsep, MCE, MBA, PE	Villanova University; Drexel University
Jared Reigstad, MCE, PE	Norwich University
Adam Sevi, PhD	University of Missouri - Rolla
William Sitzabee, PhD, PE	North Carolina State University
Timothy Tyler, PhD, PE	Virginia Polytechnic University
Loren Wehmeyer, PhD	The University of Iowa
Ruth Wertz, MSCE, PE	Purdue University
Brent White, MCE, PE	Norwich University
Anthony Young, MCE, PE	Norwich University

Courses

CE 501. Hydraulics for Environmental Engineers. 3 Credits.
A review of fluid mechanics and hydraulics fundamentals. Pipe flow and networks, open channel flow, measurement techniques for fluids.

CE 503. Fundamentals of Soil Mechanics and Foundation Engineering. 6 Credits.
Fundamentals of Soil Mechanics: an introduction to the engineering properties of soils: theory of soil compression and shear strength with practical applications. Fundamentals of Foundation Engineering: determination of bearing capacity and settlement characteristics of shallow and deep foundations. Design and evaluation of earth slopes and earth retaining structures. Prerequisite: acceptance into the Master of Civil Engineering program.

CE 505. Engineering Analysis Techniques. 3 Credits.
A fast-paced review of fundamental techniques from typical undergraduate level calculus courses. Mastery of these topics is required for success in the differential equations and engineering analysis courses in the MCE program.

CE 506. Engineering Mechanics I. 3 Credits.
A review of engineering mechanics fundamentals from the fields of statics, dynamics, and mechanics of materials. Free body diagrams, force systems, equilibrium, geometric properties, kinematics, kinetics, stress and strain.

CE 507. Fundamentals of Structural Engineering. 6 Credits.
A review of the basic concepts of structural engineering that form the required background for later courses. Types of structures, construction materials, structural design, and safety issues are discussed. Students will become familiar with a number of typical structural design calculation methods for later use.

CE 509. Fundamentals of Environmental/Water Resources Engineering. 6 Credits.
A review of the basic concepts of environmental and water resources engineering that form the required background for later courses. Basic concepts from environmental chemistry, ecology, biology, microbiology, geology, and soil science along with an introduction to environmental engineering field. Designed to prepare students for entry into the Environmental Engineering / Water Resources concentration of the Master of Civil Engineering program.

CE 523. Intermediate Soil Mechanics and Foundation Engineering. 6 Credits.
Intermediate Soil Mechanics: general principles of soil mechanics and their applications, including soil structure, mineralogy, fluid flow through porous media, shear strength, slope stability, primary consolidation and secondary consolidation. Classical earth pressure theories. Subjects will be presented from a theoretical perspective and include practical applications. Foundation Engineering: analysis of shallow and deep foundations including bearing capacity and settlement of shallow footings, floating foundations, drilled piers and piles. Analysis of stability and design of retaining walls and anchored bulkheads. Prerequisite: EG 501 (Engineering Mathematics) or permission of Program Director.

CE 525. Physiochemical & Biological Processes in Water & Wastewater Treatment. 6 Credits.
Physical, chemical, biological, and advanced treatment unit processes. This course will cover basic physical, chemical and biological concepts, reactor kinetics, water and wastewater qualities and quantities, and physical, chemical, and biological unit processes. Design of individual unit processes and integration of unit processes into treatment trains capable of meeting treatment objectives will be emphasized. Prerequisite: EG 501.

CE 528. Classical, Matrix, and Dynamic Analysis of Structures. 6 Credits.
This course addresses two tracks of analysis. First, static analysis is investigated with advanced classical methods and with matrix methods, the cornerstone of the finite element method. Second, dynamic analysis is presented using both classical and matrix approaches for single and multiple degree of freedom systems. Analysis issues related to design codes are addressed for both static and dynamic conditions. The use of commercially available software is introduced. Prerequisite: EG 501.

CE 529. Information Technology. 6 Credits.
This course develops a base level competency in a host of project management software products. Virtual Design and Construction applications as well as enterprise wide IT solutions will be examined. In addition it develops an understanding of the importance of integrating an information technology strategy across all aspects of the project and the organization. Prerequisite: EG 501 (Engineering Mathematics) or permission of Program Director.

CE 533. Earthquake Engineering and Soil Stabilization. 6 Credits.
Earthquake Engineering: evaluation of geotechnical earthquake hazards and mitigation. Plate tectonics, seismicity, wave propagation, characterization of ground motions, theory of vibrations, effect of local soil conditions on ground response, development of design ground motions, liquefaction, dynamic lateral earth pressures, slope stability and deformation, earthquake design codes. Soil Stabilization: the application of mineralogical and physicochemical principals to soil stabilization problems, and stabilization techniques for highway and foundation applications. Prerequisite: CE 523 (Intermediate Soil Mechanics and Foundation Engineering) or permission of Program Director.

CE 535. Stormwater Management and GIS Applications for Water Resources. 6 Credits.
Storm water management issues, from both flood control and water quality points of view, are integral water resource components associated with land development, urbanization, and watershed hydrology. This course will examine rainfall-runoff relationships (including statistical analysis), channel and basin routing, storm water treatment, low impact development, best management practices, and wetland utilization and benefit/cost ratio analysis. Geographic Information Systems (GIS) software will be introduced and applied for examining and analyzing decision-making processes involved with the storm water management components of the course.

CE 538. Design of Steel and Timber Structures. 6 Credits.
An exploration of advanced structural design issues in the areas of both steel and timber. Using the latest provisions from the American Institute of Steel Construction and the National Design Specification for Wood Construction the course will cover the design and behavior of 2-D and 3-D framing, framing members and connections under various loading conditions, including wind and seismic. Strength and serviceability issues.

CE 539. Contracts and Insurance. 6 Credits.
This course addresses the risk characteristics of various contractual forms and the place that insurance and surety plays in the AEC arena. The emergence of new contractual forms from AIA and the Consensus Docs require a new perspective on contracts and the project organization. This seminar will develop a strategic understanding of contract variables that span plans and specs to Integrated Project Delivery. Prerequisite: CE 529 (Information Technology) or permission of Program Director.

CE 553. Computer Modeling in Geotechnical Engineering and Geotechnical Engineering Case Histories. 6 Credits.
Survey of computer methods and applications for analysis of complex geotechnical engineering problems. Finite element, finite difference and closed form solution techniques, modeling applications. Review of select geotechnical engineering case studies. The course will also spend time formulating proposals for the student's upcoming capstone design project in CE 561. Prerequisite: CE 533 (Earthquake Engineering and Soil Stabilization) or permission of Program Director.

CE 555. Geoenvironmental Engineering - Groundwater Flow and Waste Containment. 6 Credits.
This course approaches the field of geoenvironmental engineering from two points of view: groundwater flow and contaminant transport issues and the principals related to solid waste disposal and containment. The groundwater portion of the course will focus on flow and contaminant transport including aquifer properties, principles of ground-water flow, flow into wells, soil moisture and ground-water recharge, regional ground-water flow and the advection, diffusion and attenuation of ground-water contaminants. The solid waste portion of the course will focus on landfill siting, design and construction. Material properties and engineering design of geosynthetic components including geomembranes, geotextiles, geocomposites, and geosynthetic clay liners. Methods to estimate and design landfill leachate quantities and gas generation. The course will also spend time formulating proposals for the student's upcoming capstone design project in CE 561.

CE 558. Design of Reinforced and Prestressed/Precast Concrete Structures. 6 Credits.
This course focuses on advanced topics in reinforced concrete design and an introduction to prestressed / precast concrete using the provisions of the American Concrete Institute. Beams, slabs, columns, deflections, analysis and design of prestressed members, loss calculations, use of standard precast members. Design and detailing for seismic loads. The course will also spend time formulating proposals for the student's upcoming capstone design project in CE 561.

CE 559. Project Finance and Accounting. 6 Credits.
This course focuses on understanding project risk and financial performance across all project participants. It will address traditional financial arrangements as well as new models such as the Special Purpose Entity (SPE) and Public Private Partnerships (PPP). This seminar will enable the student to address the ever increasing complexity of the financial arena. The course will also spend time formulating proposals for the student's upcoming capstone design project in CE 561. Prerequisite: CE 539 (Contracts and Insurance) or permission of Program Director.

CE 561. Capstone Design Project. 6 Credits.
Civil engineering projects have always had social, political, economic, and environmental impacts. The capstone design project requires you to anticipate these impacts prior to project implementation. As the engineer in a leadership position you will direct the project from conception to completion. This includes the preparation of a comprehensive project business plan that will include project goals, political hurdles, anticipated revenues and expenses, marketing, facility design, etc.; all pertaining to the design of a major civil engineering project.

CE 571. Elementary Geotechnical Tools Laboratory. 1 Credit.
Survey of techniques for classification of soils, assessment of hydraulic properties, consolidation, and assessment of shear strength parameters of soils. Field experience in geotechnical exploration. Corequisite: CE 503 (Fundamentals of Soil Mechanics and Foundation Engineering) or permission of Program Director.

CE 572. Intermediate Geotechincal Tools Laboratory. 1 Credit.
Survey of techniques for assessing permeability of soils using the flexible wall apparatus, Proctor compaction and triaxial shear testing. Field visit to geotechnical project site. Prerequisite: CE 553 (Numerical Methods in Geotechnical Engineering) or permission of Program Director.

CE 595. Residency. 0 Credits.