# Undergraduate Student Handbook

**The student handbook**
**for programs in**
**Civil Engineering (CivE)**
**Environmental Engineering (EnvE)**
**Geoengineering (GeoE)**
**is currently being revised.**
**See your CEGE Advisor with**
**questions.**


**Department of Civil, Environmental, and Geo- Engineering**
**Civil Engineering Building**
**500 Pillsbury Drive SE**
**Minneapolis, MN 55455**
**612-625-5522**
**http://www.ce.umn.edu**



This publication is available in electronic format at
http://www.ce.umn.edu/assets/forms/undergrad_forms/undergraduate_handbook.pdf



Updated November 18, 2014

Department of
Civil, Environmental, and Geo- Engineering

College of Science & Engineering
University of Minnesota

The undergraduate program in civil engineering, environmental or geoengineering is the first step in preparing yourself to enter a profession that directly impacts our everyday lives. Whether it is roads, bridges, dams, water supply systems, pollution control, or a hundred other elements of our infrastructure, civil engineers, environmental engineers and geoengineers play a key role in developing and maintaining these systems.

The undergraduate programs in civil engineering, environmental engineering, and geoengineering will prepare you to enter directly into the profession or prepare you to continue your education as a graduate student. In addition to your classroom studies, you will have the opportunity to participate in extra-curricular activities of both a social and professional nature, to gain valuable work experience, and to expand your horizons by studying abroad.

You are encouraged to seriously consider the many opportunities available in the fields of civil engineering, environmental engineering, and geoengineering and to further explore the undergraduate and graduate programs here at the University of Minnesota.

The purpose of this handbook is to introduce you to the Department of Civil, Environmental, and Geo- Engineering and make your experience as an undergraduate student in the department a little easier. Hopefully, a lot of the answers to questions you may have can be found in this guide. Please use this handbook as a guide only; if you have any questions regarding your degree plan or your academic career please contact your adviser or the Department of Civil, Environmental, and Geo- Engineering at 612-625-5522. Another helpful resource is the department's website at www.cege.umn.edu.


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# 2014-2015 Academic Calendar

## Fall Semester 2014

### September

1 University closed for Labor Day holiday
2 Fall semester classes begin Tuesday
9 Last day for students enrolled in fall semester to add a course without instructor approval
15 Last day for students enrolled in fall semester to cancel a class and not receive a "W" on transcript
16 Last day for undergraduates to apply for fall graduation

### November

10 Last day to cancel full semester classes without college approval
11 Spring 2014 registration begins for admitted degree-seeking students
27 University closed
28 University closed

### December

5 Spring 2014 registration begins for non-degree and visiting students
10 Last day of classes for fall semester
11 Study day/ CEGE Departmental Graduation Ceremony and Reception
12–13 Final examinations
15-18 Final examinations
25–26 University closed

## Spring Semester 2015

### January

1-19 University closed
20 Classes begin for spring semester

### February

3 Last day for undergraduates to apply for spring graduation

### March

16-20 Spring break
26 Last day for undergraduates to apply for May session graduation

### April

7 May session and summer term registration begins for admitted degree-seeking students
9 Fall 2014 registration begins for admitted degree-seeking students
14 May session and summer term registration begins for non-degree and visiting students

## Spring Semester 2015 (continued)/May Session 2015

**May**

1 Fall 2014 registration begins for non-degree and visiting students
8 Last day of classes for spring semester
11–16 Final examinations
15 CSE Spring Graduation 7:00 p.m. Mariucci
15 CEGE Departmental Graduation Ceremony and Reception
25 University closed

## May Session 2015 (continued)/Summer Term 2015

**June**

9 Last day for undergraduates to apply for summer graduation
12 Last day of May session
15 First day of summer term

**July**

3 University closed
10 Last day of first 4-week summer term
13 First day of second 4-week summer term

**August**

7 Last day of 8-week and second 4-week summer term

For more detailed calendar, please see http://onestop.umn.edu/calendars/.

# Department Directory

**Department of Civil, Environmental, and Geo- Engineering**
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## Department Administration

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**Directors of Undergraduate Studies (DUGS)**

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## Department Faculty

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# Mission Statement and Program Educational Objectives

The mission of the Department of Civil, Environmental, and Geo- Engineering is *Engineering for the Benefit of Society*. The Department of Civil, Environmental, and Geo- Engineering creates and disseminates knowledge and technologies applied to the built and natural environments. We develop innovative solutions for the design, construction and operation of sustainable infrastructure systems that ensure the safety, health, and well-being of society. Knowledge is disseminated via classroom and outreach instruction, by mentoring and advising students, by presentations at professional meetings and by articles, books and other written documents.

The program educational objectives are such that the graduates of the civil engineering, environmental engineering, and geoengineering program will

1. practice technical proficiency and adaptability, and participate in life-long learning to meet the challenges facing the profession in civil engineering industries, government agencies, academia, or other careers;
2. exhibit strong communication, interpersonal, and management skills as leaders and team members in their profession;
3. realize their role as ethical professionals that protect and sustain human health, welfare, and the environment.

The Department of Civil, Environmental, and Geo- Engineering offers three degrees that are accredited by the Engineering Accreditation Commission (EAC) of the Accreditation Board for Engineering and Technology (ABET) that are described in Sections II and III.

- Bachelor of Civil Engineering (B.C.E.)
- Bachelor of Environmental Engineering (B.EnvE.)
- Bachelor of Geoengineering (B.GeoE.)

# I. General Information, Policies, Procedures, and Important Deadlines

Fall Semester classes begin Tuesday, September 2, 2014
Spring Semester classes begin Tuesday, January 20, 2015

The general policies regarding issues such as registration, grading, and attendance can be found on the University of Minnesota OneStop website including the deadlines and procedures. For your convenience, links to particular topics are provided in the sections below. The link to the College of Science and Engineering Policies, Procedures and Forms website is http://cse.umn.edu/services/advising/CSE_CONTENT_188611.php.

## 1. Advising

Lower Division Advising

All lower division students in the college are assigned a college advisor once they have enrolled. The advisor is assigned based on cluster areas, meaning that each advisor has several majors that he/she "specialize" in, although all are trained to help with any major. Students are required to have contact with their advisor or the advising office every semester until they are admitted to their major. The first semester students meet one-on-one with their academic advisor. Second semester freshmen also meet one-on-one. Fall semester of the sophomore year, students attend a CSE college meeting where they learn more about opportunities and recommendations from advising/academics, the career center, and collegiate life. The majority of students are admitted to their major following fall semester of their sophomore year. The link to the college advising resources is http://cse.umn.edu/services/advising/index.php. Four year plans are available for planning purposes at http://cse.umn.edu/services/advising/CSE_CONTENT_188609.php.

Upper Division Advising

New upper division students in the Department of Civil, Environmental, and Geo- Engineering must attend an advising session upon admittance. Notification of advising sessions are posted throughout the civil engineering building and sent through e-mail. A student will not be allowed to register without proof of attendance.

All upper division students are assigned a faculty advisor. The Department of Civil, Environmental and Geo- Engineering requires all upper division civil engineering, environmental engineering, and geoengineering students to meet with their faculty adviser at least once per semester. An advising hold is placed prior to registration, preventing a student from registering for classes. It is the responsibility of the student to contact the faculty adviser and request an appointment at least ten days prior to the meeting. Sample programs should be viewed and studied prior to the appointment. At the program level, the APAS (Academic Progress Audit System) report is used for checking progress towards graduation. The department recognizes the importance of faculty-student interaction, and the advising requirement will help to build a relationship at the program and professional levels. Contact with a faculty adviser is critical for considering intern and research opportunities, discussing career options, including graduate studies, reviewing academic progress, and selecting technical electives. Furthermore, a letter of recommendation from a faculty member is often needed for employment or graduate

school applications. Thus, it is imperative for students to meet with their faculty adviser to discuss academic interests and career opportunities. In general, your adviser will not change during your time as an undergraduate student. However, it is possible that a faculty adviser is not available due to a medical or sabbatical leave, in which case another adviser will be assigned. Probationary status review requires contacting and meeting with the Director of Undergraduate Studies, who is also available for an advising appointment.

Students are strongly encouraged to interact with faculty at the course, program, and professional levels. Contact with faculty is important for making technical elective selections, career decisions (especially regarding graduate studies), and for letters of recommendations. Students should contact their faculty adviser for situations including (a) course substitution requests, (b) review and approval of technical electives not included on the list of approved technical electives, (c) degree requirements including required adjustments to APAS, and (d) research, career, scholarship, and employment opportunities. Probationary status review requires contacting and meeting with the appropriate Director of Undergraduate Studies (DUGS).

At the program level, the APAS (Academic Progress Audit System) report is used for checking progress towards graduation. At the course level, many students self-advise using the sample program plans found in Section II.9 and III.9. Some areas of emphasis have longer prerequisite hierarchies associated with technical elective choices, so it is beneficial for students to consult their faculty advisor regarding the most expeditious plan. It is important to note that required courses are offered every semester, whereas, technical elective classes are offered less frequently. The student should discuss with their advisor appropriate technical electives and how to best fit them into their plan. The sample program plans should only be viewed as a guide.

It is possible that the faculty adviser's expertise may be outside of the student's area of interest. The student's adviser can provide information on appropriate faculty contacts and can assist in arranging a meeting. Questions concerning specific areas of civil engineering or geoengineering can also be addressed to faculty representatives on the undergraduate studies committee:

- Environmental: Professor Timothy Lapara <lapar001@umn.edu>
- Geomechanics: Professor Randal Barnes <barne003@umn.edu>
- Structures: Professor Carol Shield <ckshield@umn.edu>
- Transportation: Professor David Levinson <levin031@umn.edu>
- Water Resources: Professor Vaughan Voller <volle001@umn.edu>

Students can also contact the directors of undergraduate studies (DUGS) for the three degree programs offered in the department:

- DUGS Civil Engineering: Professor Mihai Marasteanu <maras002@umn.edu>
- DUGS Environmental Engineering: Professor Timothy LaPara <lapar001@umn.edu>
- DUGS Geoengineering: Professor Randal Barnes <barne003@umn.edu>

**2. Application to Upper Division**

Upper division (within the major) corresponds to students who have been admitted into the civil engineering, environmental engineering, or geoengineering programs. Students must complete particular courses prior to admission into the upper division programs. Sections II.2, III.2, V.2

list the requirements for admission to the civil engineering, environmental engineering, and geoengineering programs, respectively. To be guaranteed admission, students must have a 3.2/4.0 Technical GPA at the end of fall semester. All other students who have completed the required courses will be considered for admission on a space-available basis. Admission following spring semester is based on space-availability, with preference given to those applying for the first time with a Technical GPA of 3.2 or above. Freshman and transfer students are usually admitted to pre-major status before formal admission to the major. It is recommended that students take CE 1101, Civil Engineering Seminar, but this course is not required to be admitted to the program. For more information about University of Minnesota admission requirements, see Admissions and Prospective Student Services (http://www.catalogs.umn.edu/download/TCug/cse10-12.pdf) in the University Catalog, or visit the Office of Admissions (http://admissions.tc.umn.edu/) web site.

**3. Registering for Courses**

Prior to registering for your courses you should meet with your advisor. In lower division, you are required to meet with your professional advisor. In upper division, you are also required to meet with your faculty advisor. An advising hold will be placed on your record until you meet with your advisor. The following is a list of important links related to registration. Please note that some courses require prerequisites including minimum grades achieved in those courses (e.g., C- or better). This information can be found in the University Course Catalog and on line when registering. You are responsible for ensuring that you meet the prerequisites.

Gaining Admission to a Closed Course and Permission numbers

To register for a class that is closed or requires permission, contact the instructor teaching the class. Permission numbers are not automatically granted. After the second week of class, permission numbers will no longer be available. You will have to fill out the Academic Petition Policy and get the instructor to sign the form. It then gets submitted to the CSE Advising Office(105 Lind Hall).
http://onestop.umn.edu/registration/guidelines/closed_classes/index.html
http://onestop.umn.edu/forms/

Changing Registration

*Cancel/Add of courses*
http://onestop.umn.edu/calendars/cancel_add_refund_deadlines/index.html
*Change of grade options*
http://onestop.umn.edu/grades_and_transcripts/grades/grade_basis.html
*Fees associated with late registration*
http://onestop.umn.edu/finances/costs_and_tuition/fees/serviceusagefees/late_registration_fees.html
*Actions which affect transcript (e.g., course withdrawal)*
http://onestop.umn.edu/registration/change/index.html

Mandatory Class Attendance

http://onestop.umn.edu/registration/prepare/first_day.html

**4. Grades**
Per University guidelines, students must obtain a grade of at least "C-" in all courses required for degrees in civil engineering (CE), environmental engineering (EnvE), and geoengineering (GeoE). Students who receive a "D" or lower in a required course must re-take the course. Per University guidelines, students may re-take a course only once.

**5. Academic Probation**
Students are required to maintain certain semester and overall GPAs. If these requirements are not met, the student is placed on academic probation which may delay registration and may result in suspension.
http://policy.umn.edu/Policies/Education/Education/ACADPROBATION.html#750
http://cse.umn.edu/prod/groups/cse/@pub/@cse/documents/asset/cse_asset_353216.pdf

**6. Academic Honesty**
Academic honesty is of utmost importance. Students are responsible for their own work, even in group settings. It is as important not to share your work with someone as it is for someone not to use your work. What is considered "sharing" work is different in some classes than others and it is based on the instructor's guidelines. It is your responsibility to check those guidelines to ensure that you are in compliance with the course policy. Actions which can result from academic dishonesty can involve getting a zero for the work, failing a course, and suspension from the university.
http://www.oscai.umn.edu/conduct/student/index.html

**7. Degree Progress and Graduation Planning Tools**
There are two primary tools available to you to navigate your way towards graduation: the Academic Progress Audit System (APAS) Reports and the Graduation Planner.

The APAS report is the primary tool that the university uses to check your compliance with the graduation requirements. The APAS system is automatic, and in some cases, may not accurately reflect that you have met some of your requirements (e.g., technical elective requirements). It is encouraged that you check your APAS at least once each semester to assess your progress and identify any adjustments that may need to be made. It is your responsibility to check that you have met all of the appropriate degree requirements, which may entail meeting with your faculty advisor to make some modifications to your APAS to accurately reflect that your requirements have been met. This should be done well before graduation.

The graduation planner is a tool that you can use to create a course plan that fits your individual scheduling preferences in achieving the degree requirements (See sample plans in the CE and GeoE sections of this handbook).

Academic Progress Audit System (APAS) Reports
http://onestop.umn.edu/degree_planning/apas.html

Graduation Planner
http://onestop.umn.edu/degree_planning/graduation_planner.html

**8. Graduation and Application for Degree**

A graduation checklist is available online at
http://onestop.umn.edu/degree_planning/graduation/index.html

Students must submit an Application for Undergraduate Degree early in their last semester to be cleared for graduation and to participate in the commencement ceremony. If you fail to apply by the deadline, you may not be able to graduate until the following term. You can check the due dates and download the form at
http://onestop.umn.edu/degree_planning/graduation/degree_application.html

For questions about the College of Science and Engineering graduation ceremonies, students can contact CSE Student Services, csecommencement@umn.edu or 612-624-2890, with any questions or concerns about graduation.

The Department of Civil, Environmental, and Geo- Engineering holds a departmental ceremony just for civil engineering, environmental engineering, and geoengineering students at the end of fall and spring semesters. Graduating students will get an email towards the middle of the semester with details of the ceremony and posters will be put up in the CE building announcing the ceremony and how to participate. Family and friends are encouraged to attend the event. It gives the faculty the opportunity to congratulate you and see you off. Students can contact the CE front office, CivE 122, with any questions about the departmental graduation.

**9. Transcripts**

Transcripts (official and unofficial) may be obtained at One Stop
http://onestop.umn.edu/grades_and_transcripts/index.html

**10. Collegiate Fees**

The CSE computer fees are charged to students in the College of Science and Engineering and some students in other colleges. The fees will be assessed at enrollment.
http://onestop.umn.edu/finances/costs_and_tuition/fees/college_and_program_fees.html

**11. Honors**

The University Honors Program (UHP) serves all undergraduate honors students at the University of Minnesota -Twin Cities, aiding them in their creation of an enriched, interdisciplinary educational experience. Honors experiences are achieved through a combination of coursework and other experiences. Further information can be found in Section V.1 *Honors Program* and at http://cse.umn.edu/services/advising/CSE_CONTENT_188610.php.

**12. Research Opportunities**

One of the advantages of attending a large research university is the multitude of opportunities for undergraduate students to become involved in cutting edge research. Students can participate on projects as undergraduate research assistants or propose their own research projects to the Undergraduate Research Opportunities Program (UROP).

The Undergraduate Research Opportunities Program (UROP) offers financial awards twice yearly to full-time undergraduates for research, scholarly, or creative projects undertaken in

partnership with a faculty member. UROP offers a maximum award of $1,700 ($1,400 in a stipend for the hours worked on the project and $300 for supplies and expenses required by the project).

Undergraduate students in all colleges are welcome to participate in the program and are able to work with any University faculty member. Applications are judged on the quality of the proposed project and the educational benefit to the student. Although the program is competitive, funding rates are often over 80 percent.

Application deadlines are in early March for a July 1 start date and in early October for a January 1 start date. Information and applications are available from the UROP office in 325 Johnston Hall, 612-625-3853 or online at www.urop.umn.edu.

Students are encouraged to meet with faculty within their areas of interest to explore potential project opportunities. Besides the UROP, some faculty members hire undergraduate research assistants at an hourly wage to assist on their research projects.

**13. Intern and Cooperative Education (Co-op) Programs and Employment Opportunities**

The department helps to forge relationships between the programs and the professional community through offering internships and cooperative education work experiences for our undergraduate students. A description of these programs is found in Section VI.1 *Intern and Cooperative Education (Co-op) Programs*. In addition, for our graduating seniors, the department offers a number of professional development services including assistance with resume writing and interviewing skills through a series of "brown bag" seminars, as well as a career fair which is hosted with the American Society of Civil Engineering (ASCE) Student Chapter. Please see SectionVII.1 *Employment Opportunities for Graduating Students*.

**14. Professional Licensure and the Fundamentals of Engineering Exam**

Professional licensure is strongly encouraged for individuals seeking careers in engineering. Licensure requires successful passage of two examinations and several years of experience. The FE Exam is the first of the two examinations engineers must pass in order to be licensed as a Professional Engineer. Students are encouraged to take the Fundamentals of Engineering (FE) Exam in their senior year. Statistics show that they have a greater success rate compared to graduates as the exam covers some of the basic undergraduate course material. In 2014 and beyond, the exam format will change from the current pen-and-paper format to a computer-based test (CBT) format. Additionally in 2014, the exam can be scheduled every two out of every three months; it is currently offered twice a year.

**IMPORTANT:** Students who wish to take the FE Exam must first apply to the Minnesota Board of Architecture, Engineering, Land Surveying, Landscape Architecture, Geoscience and Interior Design (AELSLAGID) for approval to sit for the exam in Minnesota (deadline: August 12 for the October 2013 exams). After the board has approved the application, the student must then register online with National Council of Examiners for Engineering and Surveying (NCEES) (deadline: September 5, 2013) to reserve a seat for the exam.
Useful links:

- AELSLAGID website, exam dates and deadlines:

http://mn.gov/aelslag/engineering.html
http://mn.gov/aelslag/deadlines.html.

- NCEES website:
  http://ncees.org/exams/state-pages/minnesota-exam-registration/.

**15. Diversity Programs**

There are a number of opportunities including scholarships and organizations devoted to the diverse student body population. More information is available at http://cse.umn.edu/services/diversityoutreach/index.php

**16. Graduate School**

The Department of Civil, Environmental, and Geo- Engineering is dedicated to educating graduate students in the diverse disciplines represented within its degree programs of civil engineering and geoengineering. Graduate study enables a student to develop in-depth knowledge in one or more specialized fields, to reach the frontiers of current knowledge, and to expand those frontiers by doing original research. It also teaches students how to work independently and think critically about one's own work and that of others. Faculty members help graduate students reach these goals in challenging coursework and research seminars, by encouraging informal discussions, and by providing guidance during all stages of a student's research.

The department offers integrated Bachelor of Engineering/Master of Science degrees in civil engineering and geoengineering. A description of this program is found in Section IV.1 *Bachelor of Engineering/Master of Science Integrated Program*. For more information on graduate school, please contact the Director of Graduate Studies, Professor Arturo Schultz, schul088@umn.edu.

## 17. Important Deadlines

- Application to Upper Division: Fall Semester – May 25, Spring Semester – December 30
- Meeting with department adviser: After getting admitted into upper division and prior to registration each semester
- Applying for upper division scholarships and awards: Beginning of spring semester
- Application to BS/MS program: Fall admission, May 1:, Spring admission, October 1
- Application for UROP: http://www.urop.umn.edu/
- Registration for FE exam: http://ppi2pass.com/faqs/FE_EIT_Exam_FAQs#dates
- Application to Graduate School: Fall admission Dec 3, Spring admission August 31
- Application for graduation:

**Undergraduate Degree Application Deadlines**

| Term of Graduation | Application Deadline |
|---|---|
| Fall 2014 | September 16, 2014 |
| Spring 2015 | February 3, 2015 |

# II. Bachelor of Civil Engineering (B.C.E.)

Civil engineering deals with the science and art of engineering applied to solving problems and designing systems related to infrastructure and the environment. The main areas within civil engineering are:

- **Environmental engineering:** The systematic control of air, water, and land pollution to protect the public health and enhance environmental quality by providing for safe water supplies, treatment and disposal of wastewater, and solid waste management systems.
- **Geomechanics:** The analysis of the properties of soils and rocks and applications to the design of foundations, retaining walls, roads, slopes, dams, and tunnels.
- **Structural engineering:** The design and analysis of buildings, bridges, industrial facilities, and other structures built with concrete, steel, reinforced or prestressed concrete, masonry, and other materials.
- **Transportation engineering:** The economics, planning, design, construction, maintenance, and administration of transit systems, highways, railroads, airways, pipelines, and transmission lines for the conveyance of passengers, materials, and energy.
- **Water resources engineering:** The application of fluid mechanics, hydrology, and other basic knowledge to the design and operation of water resource systems.

The upper division civil engineering program requires students to take introductory courses in all of these areas. In addition, students may emphasize a special interest in one of the areas by selecting appropriate technical electives in consultation with their adviser.

**1. General Requirements**

The four-year program leading to the B.C.E. requires a minimum of 125 credits. The first two years are almost identical to those in other CSE engineering programs. Students may transfer to civil engineering from another CSE engineering program, another University college or campus, or another academic institution provided they meet transfer requirements. All students are required to complete general University and college requirements, including writing and liberal education courses, in order to graduate. For more information about University-wide requirements, see the liberal education requirements, http://onestop.umn.edu/degree_planning/lib_eds/index.html. Note that to achieve the minimum of 125 credits, it is assumed that some of the liberal education requirements will be met by "double-dipping" designated liberal education theme courses with liberal education core courses and other courses within the curriculum. Required courses for the major or minor in which a student receives a D grade (with or without plus or minus) do not count toward the major or minor (including transfer courses).

**2. Admission Requirements**

Students must complete the following starred (*) courses before admission to the B.C.E. program, and meet GPA requirement of 3.2 for admission. (http://cse.umn.edu/services/advising/CSE_CONTENT_188758.php) set by CSE. Freshman and transfer students are usually admitted to pre-major status before admission to this major.

It is recommended that students take CE 1101, but this course is not required to be admitted to the program. For more information about University of Minnesota admission requirements, see Admissions and Prospective Student Services in the University Catalog, or visit the Office of Admissions web site.

Mathematics (16 cr)
MATH 1371 - CSE Calculus I [MATH] (4.0 cr)
*or* MATH 1271 - Calculus I [MATH] (4.0 cr)
MATH 1372 - CSE Calculus II (4.0 cr)
*or* MATH 1272 - Calculus II (4.0 cr)
* MATH 2374 - CSE Multivariable Calculus and Vector Analysis (4.0 cr)
*or* MATH 2263 - Multivariable Calculus (4.0 cr)
MATH 2373 - CSE Linear Algebra and Differential Equations (4.0 cr)
*or* MATH 2243 - Linear Algebra and Differential Equations (4.0 cr)
Honors math (MATH 1571H, 1572H, 2574H, and 2573H, respectively) may be taken in place of the listed courses.

Physical Science and Mechanics (25-26 cr)
* AEM 2011 - Statics (3.0 cr)
AEM 3031 - Deformable Body Mechanics (3.0 cr)
AEM 2012 - Dynamics (3.0 cr)
*or* CHEM 2301 - Organic Chemistry I (3.0 cr)
*or* EE 2001 - Introduction to Circuits and Electronics (3.0 cr)
*or* MATS 2001 - Introduction to the Science of Engineering Materials (3.0 cr)
*or* CSCI 1113 - Introduction to C/C++ Programming for Scientists and Engineers (4.0 cr)
*or* ME 3331 - Thermal Sciences I (3.0 cr)

CHEM 1061 - Chemical Principles I [PHYS] (3.0 cr) and
CHEM 1065 - Chemical Principles I Laboratory [PHYS] (1.0 cr)
*or* CHEM 1071H - Honors Chemistry I [PHYS] (3.0 cr) and
CHEM 1075H - Honors Chemistry I Laboratory [PHYS] (1.0 cr)
* CHEM 1062 - Chemical Principles II [PHYS] (3.0 cr) and
* CHEM 1066 - Chemical Principles II Laboratory [PHYS] (1.0 cr)
*or* CHEM 1072H - Honors Chemistry II [PHYS] (3.0 cr) and
CHEM 1076H - Honors Chemistry II Laboratory [PHYS] (1.0 cr)

PHYS 1301W - Introductory Physics for Science and Engineering I [PHYS, WI] (4.0 cr)
*or* PHYS 1401V - Honors Physics I [PHYS, WI] (4.0 cr)
* PHYS 1302W - Introductory Physics for Science and Engineering II [PHYS, WI] (4.0 cr)
*or* PHYS 1402V - Honors Physics II [PHYS, WI] (4.0 cr)

Civil Engineering (6 cr)
* CE 3101 - Computer Applications in Civil Engineering I (3.0 cr)
* CE 3102 - Uncertainty and Decision Analysis in Civil Engineering (3.0 cr)
*STAT 3021 may substitute CE 3102 with approval of the director of undergraduate studies.*

**3. Program Requirements**
The *upper division* program requires courses in transportation, soil mechanics, fluid mechanics, water resources, environmental sciences, structures, and engineering design. The credit requirements are as follows:

Civil Engineering (37 cr)
CE 3201 - Transportation Engineering (3.0 cr)
CE 3301 - Soil Mechanics I (3.0 cr)
CE 3401 - Linear Structural Analysis (3.0 cr)
CE 3402W - Civil Engineering Materials (3.0 cr)
CE 3501 - Environmental Engineering (3.0 cr)
CE 3502 - Fluid Mechanics (4.0 cr)
CE 4102W - Capstone Design (4.0 cr)
CE 4301 - Soil Mechanics II (3.0 cr)
CE 4401 - Steel and Reinforced Concrete Design (4.0 cr)
CE 4501 - Hydrologic Design (4.0 cr)
CE 4502 - Water and Wastewater Treatment (3.0 cr)

Technical Electives (21 cr)
In addition, 21 credits of technical electives are included in the B.C.E. degree program, as follows:

- 10 credits of electives offered by the Department of Civil Engineering. All 4XXX or higher Civil Engineering courses can be used as technical electives.
- 11 credits of technical electives. All 4XXX or higher courses from the College of Science and Engineering (including Civil Engineering) are acceptable as technical electives. In addition, CE 1101, CE 3111, and CE 3202 can be used as technical electives.

Other courses can be used as technical electives with specific approval from your CE faculty adviser. For a comprehensive list of preapproved and recommended technical electives please consult the table in Appendix A. This list of courses is already preapproved (you do not need adviser approval) and the X's indicate courses recommended by faculty in the department.

**4. Final Project**
All civil engineering students must complete CE 4102W: Capstone Design. This course is an extensive capstone design project and requires written and oral presentations of project results.

**5. Writing Intensive Requirements**
CE 3402W: Civil Engineering Materials and CE 4102W: Capstone Design meet the upper division writing intensive requirement. The requirement can also be met with ENGC 3027: Advanced Expository Writing.

**6. Summer Courses**
The Department of Civil Engineering does not offer summer courses. CE 3202: Surveying and Mapping is offered during intersession (and also in fall semester). Students who wish to attend summer classes should include liberal education courses, AEM courses, or statistics in their summer class schedule.

All Civil Engineering required courses are offered every semester. Many technical elective courses are offered once a year, but not all. Samples of the B.C.E. four year program are shown on the next pages. Sample Plan B is preferred for students interested in emphasizing structures or geomechanics because of the longer prerequisite hierarchy.

**7. FE Exam**

All seniors are strongly encouraged to take the Fundamental of Engineering (FE) examination. For more information, please consult page 14 of the handbook.

**8. Civil Engineering Degree Program Completion Plan**

Once the students are admitted into the major, each student is assigned an adviser in the department and a hold is placed on their records until they have a first meeting with their adviser. After the initial meeting with the adviser, students typically meet with their adviser on a semester basis to make sure they are on track of completing the degree program on time. In addition, students can seek advice from the director and the members of the undergraduate studies committee. Students should come prepared with a copy of their more recent APAS and any relevant additional information.

# 9. Civil Engineering Sample Program A

*This sample plan is preferred for those with water resources and environmental engineering emphases*

**Freshman Year**

*Fall Semester (17 cr)*
CE 1101 – Civil Eng. Orientation (1)
CHEM 1061 – Chem Prin I (3)
CHEM 1065 – Chem Prin I Lab (1)
MATH 1371 or MATH 1271 – Calculus I (4)
PHYS 1301W – Intro Physics I (4)
Freshman writing requirement (4)
[WRIT 1301 or 1401]

*Spring Semester (15 cr)*
CHEM 1062 – Chem Prin II (3)
CHEM 1066 – Chem Prin II Lab (1)
MATH 1372 or MATH 1272 – Calculus II (4)
PHYS 1302W – Intro Physics II (4)
Biology with lab (4)

**Sophomore Year**

*Fall Semester (17 cr)*
AEM 2011 – Statics (3)
CE 3101 – Computer Applications I (3)
CE 3102 – Uncert. and Decision Analysis(3)
MATH 2374 or MATH 2263 – Multivariable Calculus and Vector Analysis (4)
Liberal education elective (3)

*Spring Semester (16 cr)*
AEM 3031 – Deform Body Mechanics (3)
CE 3501 – Environmental Engineering (3)
MATH 2373 or MATH 2243 – Linear Algebra and Differential Equations (4)
Liberal education elective (6)

**Junior Year**

*Fall Semester (16 cr)*
AEM 2012 – Dynamics (3)**
CE 3201 – Transportation Engineering (3)
CE 3402W – Civil Eng. Materials (3)
CE 3502 – Fluid Mechanics (4)
Liberal education elective (3)

*Spring Semester (16 cr)*
CE 3301 – Soil Mechanics I (3)
CE 3401 – Linear Structural Analysis (3)
CE 4501 – Hydrologic Design (4)
CE 4502 – Water/Wastewater Treatment (3)
CE technical electives (3)

**Senior Year**

*Fall Semester (15 cr)*
CE 4301 – Soil Mechanics II (3)
CE 4401 – Steel & Reinforced Concrete Design (4)
CE technical electives (8)

*Spring Semester (13 cr)*
CE 4102W – Capstone Design (4)
CE technical electives (9)

*Substitutions can be made upon approval from the student's adviser.
**AEM 2012 can be replaced with EE 2001, MatS 2001, CSci 1113, ME 3331, CHEM 2301.
Please note that CE 1101 counts as 1 credit of technical electives.

# 10. Civil Engineering Sample Program B

*This sample plan is preferred for those with a structural engineering or geomechanics emphasis*

**Freshman Year**

*Fall Semester (17 cr)*
CE 1101 – Civil Eng. Orientation (1)
CHEM 1061 – Chem Prin I (3)
CHEM 1065 – Chem Prin I Lab (1)
MATH 1371 or MATH 1271 – Calculus I (4)
PHYS 1301W – Intro Physics I (4)
Freshman writing requirement (4)
[WRIT 1301 or 1401]

*Spring Semester (15)*
CHEM 1062 – Chem Prin II (3)
CHEM 1066 – Chem Prin II Lab (1)
MATH 1372 or MATH 1272 – Calculus II (4)
PHYS 1302W – Intro Physics II (4)
Biology with lab (4)
Liberal education elective (3)

**Sophomore Year**

*Fall Semester (17 cr)*
AEM 2011 – Statics (3)
CE 3101 – Computer Applications I (3)
CE 3102 – Uncert. and Decision Analysis (3)
MATH 2374 or MATH 2263 –Multivariable Calculus and Vector Analysis (4)
Liberal education elective (3)

*Spring Semester (16 cr)*
AEM 2012 – Dynamics (3)**
AEM 3031 – Deform Body Mech (3)
CE 3201 – Transportation Engineering (3)
MATH 2373 or MATH 2243 – Linear Algebra and Differential Equations (4)
Liberal education elective (3)

**Junior Year**

*Fall Semester (15 cr)*
CE 3301 – Soil Mechanics I (3)
CE 3401 – Linear Structural Analysis (3)
CE 3501 – Environmental Engineering (3)
Liberal education elective (6)

*Spring Semester (14 cr)*
CE 3402W – Civil Engineering Materials (3)
CE 3502 – Fluid Mechanics (4)
CE 4301 – Soil Mechanics II (3)
CE 4401 – Steel & Reinforced Concrete Design (4)

**Senior Year**

*Fall Semester (15 cr)*
CE 4501 – Hydrologic Design (4)
CE 4502 – Water/Wastewater Treatment (3)
CE technical electives (8)

*Spring Semester (16 cr)*
CE 4102W – Capstone Design (4)
CE technical electives (12)

*Substitutions can be made upon approval from the student's adviser.
**AEM 2012 can be replaced with EE 2001, MatS 2001, CSci 1113, ME 3331, CHEM 2301.
Please note that CE 1101 counts as 1 credit of technical electives.

# III. Bachelor of Environmental Engineering (B.EnvE.)

Environmental engineering deals with the science and art of engineering applied to solving problems and designing systems related to protecting and preserving the environment.

**1. General Requirements**

The four-year program leading to the B.EnvE. requires a minimum of 125 credits. The first two years are similar to those in other CSE engineering programs. Students may transfer to environmental engineering from another CSE engineering program, another University college or campus, or another academic institution provided they meet transfer requirements. All students are required to complete general University and college requirements, including writing and liberal education courses, in order to graduate. For more information about University-wide requirements, see the liberal education requirements, http://onestop.umn.edu/degree_planning/lib_eds/index.html. Note that to achieve the minimum of 125 credits, it is assumed that some of the liberal education requirements will be met by "double-dipping" designated liberal education theme courses with liberal education core courses and other courses within the curriculum. Required courses for the major or minor in which a student receives a D grade (with or without plus or minus) do not count toward the major or minor (including transfer courses).

**2. Admission Requirements**

Students must complete the following starred (*) courses before admission to the B.EnvE. program, and meet GPA requirement of 3.2 for admission. (http://cse.umn.edu/services/advising/CSE_CONTENT_188758.php) set by CSE. Freshman and transfer students are usually admitted to pre-major status before admission to this major.
It is recommended that students take CSE 1001 or CE 1101, but neither of these courses are required to be admitted to the program. For more information about University of Minnesota admission requirements, see Admissions and Prospective Student Services in the University Catalog, or visit the Office of Admissions web site.

Mathematics (16 cr)
MATH 1371 - CSE Calculus I [MATH] (4.0 cr)
*or* MATH 1271 - Calculus I [MATH] (4.0 cr)
MATH 1372 - CSE Calculus II (4.0 cr)
*or* MATH 1272 - Calculus II (4.0 cr)
* MATH 2374 - CSE Multivariable Calculus and Vector Analysis (4.0 cr)
*or* MATH 2263 - Multivariable Calculus (4.0 cr)
MATH 2373 - CSE Linear Algebra and Differential Equations (4.0 cr)
*or* MATH 2243 - Linear Algebra and Differential Equations (4.0 cr)
Honors math (MATH 1571H, 1572H, 2574H, and 2573H, respectively) may be taken in place of the listed courses.

Physical Science and Mechanics (25 cr)
* AEM 2011 - Statics (3.0 cr)
AEM 3031 - Deformable Body Mechanics (3.0 cr)

CHEM 1061 - Chemical Principles I [PHYS] (3.0 cr) and
CHEM 1065 - Chemical Principles I Laboratory [PHYS] (1.0 cr)
*or* CHEM 1071H - Honors Chemistry I [PHYS] (3.0 cr) and
CHEM 1075H - Honors Chemistry I Laboratory [PHYS] (1.0 cr)
* CHEM 1062 - Chemical Principles II [PHYS] (3.0 cr) and
* CHEM 1066 - Chemical Principles II Laboratory [PHYS] (1.0 cr)
*or* CHEM 1072H - Honors Chemistry II [PHYS] (3.0 cr) and
CHEM 1076H - Honors Chemistry II Laboratory [PHYS] (1.0 cr)
CHEM 2301 - Organic Chemistry I (3.0 cr)

PHYS 1301W - Introductory Physics for Science and Engineering I [PHYS, WI] (4.0 cr)
*or* PHYS 1401V - Honors Physics I [PHYS, WI] (4.0 cr)
* PHYS 1302W - Introductory Physics for Science and Engineering II [PHYS, WI] (4.0 cr)
*or* PHYS 1402V - Honors Physics II [PHYS, WI] (4.0 cr)

**3. Program Requirements**

The *upper division* program requires courses in thermodynamics, earth sciences, soil mechanics, fluid mechanics, water resources, materials, water/wastewater treatment, and engineering design. The credit requirements are as follows:

CE 3101 - Computer Applications in Civil Engineering I (3.0 cr)
CE 3102 - Uncertainty and Decision Analysis in Civil Engineering (3.0 cr)
*STAT 3021 may substitute CE 3102 with approval of the director of undergraduate studies.*
CE 3301 - Soil Mechanics I (3.0 cr)
CE 3402W - Civil Engineering Materials (3.0 cr)
CE 3501 - Environmental Engineering (3.0 cr)
CE 3502 - Fluid Mechanics (4.0 cr)
CE 3541 – Environmental Engineering Laboratory (3.0 cr)
CE 4102W - Capstone Design (4.0 cr)
CE 4501 - Hydrologic Design (4.0 cr)
CE 4502 - Water and Wastewater Treatment (3.0 cr)
CHEM 4501 – Introduction to Thermodynamics, Kinetics, and Stat Mechanics
ESCI 1101 – Introduction to Geology (3.0 cr)

Selected Electives (12 cr)
*Students must take two courses from each of the following lists. Note that students cannot take two courses listed on the same bulleted line because these courses are deemed to be similar (also, students cannot take one of these courses as a selected elective and the similar course as a technical elective). Students are allowed to take from than two courses from these lists, using the additional courses as technical electives:*

- *Chemistry/Ecology/Microbiology*
  - CE 4561: Solid and hazardous wastes or BBE 4533: Sustainable waste management engineering
  - CE 4562: Remediation technologies
  - CE 5541: Environmental water chemistry

    - CE 5551: Enviornmental microbiology or ESCI 4801: Geomicrobiology or BBE 4608: Industrial and environmental microbiology or BIOL 4121: Microbial ecology and applied microbiology
    - ESCI 3303W: Geochemical principles
    - MICB 3301: Biology of microorganisms
    - BIOL 3408W: Ecology
    - LAAS 5311: Soil chemistry and mineralogy
- *Water/Atmospheric Sciences/Sustainability*
    - CE 4351: Groundwater mechanics
    - CE 4512: Open channel hydraulics
    - CE 5511: Urban hydrology and land development
    - CE 5543: Introductory environmental fluid mechanics
    - CE 5571: Air quality engineering
    - CE 5571: Design for sustainable development: Innovate
    - ESCI 4702: General hydrogeology
    - ESCI 3402: Science and politics of global warming
    - ESCI 3425: Atmospheric pollution: From smog to climate change
    - BBE 4523: Ecological engineering design
    - BBE 4535: Assessment and diagnosis of impaired waters

Technical Electives (12 cr)
In addition, 12 credits of technical electives are included in the B.EnvE. degree program. Other courses can be used as technical electives with specific approval from your CE faculty adviser. For a comprehensive list of preapproved and recommended technical electives please consult the table in Appendix A. This list of courses is already preapproved (you do not need adviser approval) and the X's indicate courses recommended by faculty in the department.

Biological Sciences
Accreditation of the B.EnvE. degree by ABET requires that students take a biological science course relevant to the program of study. These courses include BIOL 1001 and BIOL 1009, which simultaneously satisfy the University's liberal education requirement for a biological sciences course with laboratory. In addition, students can take CE 5551, ESCI 4801, BBE 4608, BIOL 4121, MICB 3301, or BIOL 3408W to satisfy this requirement (these are listed as "selected electives". Other courses can be used to satisfy this requirement upon the approval of the DUGS. It is anticipated that students will satisfy this biological sciences requirement while satisfying other requirements established by the University (i.e., BIOL 1001 or BIOL 1009) or by the B.EnvE. selected elective or technical elective requirements, thus not requiring additional courses to be taken.

**4. Final Project**
All environmental engineering students must complete CE 4102W: Capstone Design. This course is an extensive capstone design project and requires written and oral presentations of project results.

**5. Writing Intensive Requirements**
CE 3402W: Civil Engineering Materials and CE 4102W: Capstone Design meet the upper division writing intensive requirement. The requirement can also be met with ENGC 3027: Advanced Expository Writing, ESCI 3303W: Geochemical principles or BIOL 3408W: Ecology.

**6. Summer Courses**
The Department of Civil, Environmental, and Geo- Engineering does not offer summer courses. CE 3202: Surveying and Mapping is offered during intersession (and also in fall semester). Students who wish to attend summer classes should include liberal education courses, AEM courses, or statistics in their summer class schedule.

All Civil Engineering required courses are offered every semester except for CE 3541. Many technical elective courses are offered once a year, but not all. The four year program is shown on the next page.

**7. FE Exam**
All seniors are strongly encouraged to take the Fundamental of Engineering (FE) examination. For more information, please consult page 14 of the handbook.

**8. Environmental Engineering Degree Program Completion Plan**
Once the students are admitted into the major, each student is assigned an adviser in the department and a hold is placed on their records until they have a first meeting with their adviser. After the initial meeting with the adviser, students typically meet with their adviser on a semester basis to make sure they are on track of completing the degree program on time. In addition, students can seek advice from the director and the members of the undergraduate studies committee. Students should come prepared with a copy of their more recent APAS and any relevant additional information.

# 9. Environmental Engineering Sample Program

## Freshman Year

*Fall Semester (17 cr)*
CSE 1001 – 1st year experience (1)
MATH 1371 or MATH 1271 – Calculus I (4)
PHYS 1301W – Intro Physics I (4)
CHEM 1061 – Chem Prin I (3)
CHEM 1065 – Chem Prin I Lab (1)
Freshman writing requirement (4)
[WRIT 1301 or 1401]

*Spring Semester (15 cr)*
BIOL 1009 Biology with lab (4)
CHEM 1062 – Chem Prin II (3)
CHEM 1066 – Chem Prin II Lab (1)
MATH 1372 or MATH 1272 – Calculus II (4)
PHYS 1302W – Intro Physics II (4)

## Sophomore Year

*Fall Semester (16 cr)*
AEM 2011 – Statics (3)
CE 3501 – Environmental Engineering (3)
CHEM 2301 – Organic Chemistry (3)
MATH 2374 or MATH 2263 – Multivariable Calculus and Vector Analysis (4)
Liberal education course (3)

*Spring Semester (16 cr)*
AEM 3031 – Deform Body Mechanics (3)
CE 3101 – Computer Appl 1 (3)
CHEM 2301 – Intro to Thermodynamics, Kinetics, and Stat. Mechanics (3)
MATH 2373 or MATH 2243 – Linear Algebra and Differential Equations (4)
Liberal education course (3)

## Junior Year

*Fall Semester (16 cr)*
CE 3102 – Uncertainty and Decision Anal. (3)
CE 3402W – Civil Eng. Materials (3)
CE 3502 – Fluid Mechanics (4)
CE 3542 – Environmental Eng. Lab (3)
ESCI 1101 – Introductory Geology (3)

*Spring Semester (15 cr)*
CE 3301 – Soil Mechanics I (3)
CE 4502 – Water/Wastewater Treatment (3)
Selected Electives (6)
Liberal Education Course (3)

## Senior Year

*Fall Semester (16 cr)*
CE 4501 – Hydrologic Design (4)
Selected Electives (3)
Technical electives (6)
Liberal Education course (3)

*Spring Semester (13 cr)*
CE 4102W – Capstone Design (4)
Selected Elective (3)
Technical electives (6)

*Substitutions can be made upon approval from the student's adviser.
**AEM 2012 can be replaced with EE 2001, MatS 2001, CSci 1113, ME 3331, CHEM 2301.
Please note that CE 1101 counts as 1 credit of technical electives.

# IV. Bachelor of Geoengineering (B.GeoE.)

Geoengineering deals with the discovery, development, and environmentally responsible production of surface and subsurface earth resources. A geoengineer applies the principles of engineering and science to the problems of planning, analysis, design, construction, and operation of facilities on and under the surface of the Earth. One type of geoengineer is a geological engineer, which refers primarily to someone who works on the pursuit of mineral resources, but geoengineering encompasses a wider range of earth resources. For example, a student graduating with a degree in geoengineering may pursue a career in underground exploration for resources such as oil and gas; underground storage of petroleum and natural gas; $CO_2$ sequestration; underground transportation systems; supply of drinking water from groundwater; isolation of nuclear and other hazardous wastes; land reclamation associated with surface; and subsurface mining. Geoengineers are involved with prediction and control of unstable dynamic releases of energy as in damaging rock bursts in mines. Geoengineers develop improved recovery of petroleum resources and study the consequences of disposal of unwanted fluids injected into rock formations at depth.

Our geoengineering degree program has three emphases:

- **Geoenvironmental**, which focuses on (1) soil and groundwater contamination and remediation; (2) solid and hazardous waste characterization, management, and disposal;
- **Geofluids**, which focuses on (1) groundwater modeling; (2) groundwater and surface water resources management and exploitation.
- **Georesources**, which focuses on (1) analysis and design of surface and subsurface excavations; (2) evaluation of natural geologic hazards.

The upper division geoengineering program requires students to take introductory courses in each of these three areas. In addition, students may emphasize a special interest in one of the areas by selecting appropriate technical electives in consultation with their adviser.

### 1. General Requirements

The four-year program leading to the B.GeoE. requires a minimum of 125 credits including 67 credits within three major fields: civil engineering, geoengineering, and earth sciences. The first two years of the geoengineering curriculum are almost identical with the first two years of the civil engineering program and are similar to those in other CSE engineering programs. Students may transfer to geoengineering from another CSE engineering program, another University college or campus, or another academic institution provided they meet transfer requirements. All students are required to complete general University and college requirements, including writing and liberal education courses, in order to graduate. For more information about University-wide requirements, see the liberal education requirements. Note that to achieve the minimum of 125 credits, it is assumed that some of the liberal education requirements will be met by "double-dipping" designated liberal education theme courses with liberal education core courses and other courses within the curriculum. Required courses for the major or minor in

which a student receives a D grade (with or without plus or minus) do not count toward the major or minor (including transfer courses).

**2. Admission Requirements**

Students must complete the following starred (*) courses before admission to the B.GeoE. program, and meet GPA requirement of 3.2 set by CSE. Freshman and transfer students are usually admitted to pre-major status before admission to this major. For more information about University of Minnesota admission requirements, see Admissions and Prospective Student Services in the University Catalog, or visit the Office of Admissions web site.

Mathematics (16 credits)

MATH 1371 - CSE Calculus I [MATH] (4.0 cr)
*or* MATH 1271 - Calculus I [MATH] (4.0 cr)
MATH 1372 - CSE Calculus II (4.0 cr)
*or* MATH 1272 - Calculus II (4.0 cr)
* MATH 2374 - CSE Multivariable Calculus and Vector Analysis (4.0 cr)
*or* MATH 2263 - Multivariable Calculus (4.0 cr)
MATH 2373 - CSE Linear Algebra and Differential Equations (4.0 cr)
*or* MATH 2243 - Linear Algebra and Differential Equations (4.0 cr)

Honors math (MATH 1571H, 1572H, 2574H, and 2573H, respectively) may be taken in place of the listed courses.

Physical Science and Mechanics (25-26 cr)

* AEM 2011 - Statics (3.0 cr)
AEM 3031 - Deformable Body Mechanics (3.0 cr)
AEM 2012 - Dynamics (3.0 cr)
*or* CHEM 2301 - Organic Chemistry I (3.0 cr)
*or* EE 2001 - Introduction to Circuits and Electronics (3.0 cr)
*or* MATS 2001 - Introduction to the Science of Engineering Materials (3.0 cr)
*or* CSCI 1113 - Introduction to C/C++ Programming for Scientists and Engineers (4.0 cr)
*or* ME 3331 - Thermal Sciences I (3.0 cr)

CHEM 1061 - Chemical Principles I [PHYS] (3.0 cr) and
CHEM 1065 - Chemical Principles I Laboratory [PHYS] (1.0 cr)
*or* CHEM 1071H - Honors Chemistry I [PHYS] (3.0 cr) and
CHEM 1075H - Honors Chemistry I Laboratory [PHYS] (1.0 cr)
* CHEM 1062 - Chemical Principles II [PHYS] (3.0 cr) and
* CHEM 1066 - Chemical Principles II Laboratory [PHYS] (1.0 cr)
*or* CHEM 1072H - Honors Chemistry II [PHYS] (3.0 cr) and
CHEM 1076H - Honors Chemistry II Laboratory [PHYS] (1.0 cr)

PHYS 1301W - Introductory Physics for Science and Engineering I [PHYS, WI] (4.0 cr)
*or* PHYS 1401V - Honors Physics I [PHYS, WI] (4.0 cr)
* PHYS 1302W - Introductory Physics for Science and Engineering II [PHYS, WI] (4.0 cr)
*or* PHYS 1402V - Honors Physics II [PHYS, WI] (4.0 cr)

**3. Program Requirements**
The *upper division* program requires courses in earth sciences, civil and geoengineering. The *upper division* program requires courses in soil mechanics, fluid mechanics, water resources, environmental sciences, earth science, and engineering design. Students are also required to select appropriate technical elective courses. For course descriptions, see University courses.

Earth Sciences (18 cr)
ESCI 2301 - Mineralogy (3.0 cr)
ESCI 2302 - Petrology (3.0 cr) or ESCI 2203 – Earth Surface Dynamics (4.0 cr)
ESCI 3891 - Field Methods (2.0 cr)
ESCI 4501 - Structural Geology (3.0 cr)
ESCI 2201 - Solid Earth Dynamics (4.0 cr)
ESCI 3911 - Introductory Field Geology (4.0 cr)
*or* ESCI 4971W - Field Hydrogeology (4.0 cr)

Civil Engineering and Geoengineering (27 cr)
CE 3101 - Computer Applications in Civil Engineering I (3.0 cr)
CE 3102 - Uncertainty and Decision Analysis in Civil Engineering (3.0 cr)
GEOE/CE 3301 - Soil Mechanics I (3.0 cr)
CE 3501 - Environmental Engineering (3.0 cr)
CE 3502 - Fluid Mechanics (4.0 cr)
CE 4311 - Rock Mechanics (4.0 cr)
GEOE/CE 4102W - Capstone Design (4.0 cr)
GEOE/CE 4121 - Computer Applications in Civil Engineering II (3.0 cr)
GEOE/CE 4351 - Groundwater Mechanics (3.0 cr)

Technical Electives (14 cr)
At least one ESCI course at the 4XXX-level or greater
At least one course from the following list:
· GEOE/CE 4301 - Soil Mechanics II (3.0 cr)
· CE 4501 - Hydrologic Design (4.0 cr)
· CE 4502 - Water and Wastewater Treatment (3.0 cr)

The rest of the technical electives may be chosen from other courses within the College of Science and Engineering (including the CE and ESCI Departments) at the 4XXX level and above. All 4XXX or higher courses from the College of Science and Engineering (including Civil Engineering) are acceptable as technical electives to fulfill the rest of the 19 credit technical elective requirement. For a comprehensive list of preapproved and recommended technical electives please consult the table in Appendix B. This list of courses is already preapproved (you do not need adviser approval) and the X's indicate courses recommended by faculty in the department. Additionally, other courses can be used as technical electives with specific approval from a student's GeoE adviser.

**4. Final Project**
All students must take GEOE 4102: Capstone Design. This course is an extensive capstone design project and requires written and oral presentations of project results.

**5. Writing Intensive Requirements**
CE 3402W: Civil Engineering Materials and GEOE/CE 4102W: Capstone Design meet the upper division writing intensive requirement. The requirement can also be met with ENGC 3027: Advanced Expository Writing.

**6. Summer Courses**
The Department of Civil Engineering does not offer summer courses. CE 3202: Surveying and Mapping is offered during intersession (and also in fall semester). Students who wish to attend summer classes should consider courses from other departments such as liberal education courses, AEM courses, mathematics, or statistics in their summer class schedule.

Many but not all of the required courses and technical electives are offered every semester. Sample GeoE four year programs are shown on the next four pages.

**7. FE Exam**
All seniors are strongly encouraged to take the Fundamental of Engineering (FE) examination. For more information, please see consult page 14 of the handbook.

**8. Geoengineering Degree Program Completion Plan**
If you have any questions about the geoengineering degree program please contact Professor Kimberly Hill at (612) 626-0311 or email her at kmhill@umn.edu. Students should come prepared with a copy of their more recent APAS and any relevant additional information.

# 9. Geoengineering Sample Program – Generic

**Freshman Year**

*Fall Semester (17 cr)*
Math 1371 (1271) – Calculus I (4)
Phys 1301W – Physics I (4)
Biology /w lab (4)
Chem 1061 – Chemical Principles I (3)
Chem 1065 – Chem I Lab (1)
CSE 1001 – First year experience (1)

*Spring Semester (16 cr)*
Math 1372 (1272) – Calculus II (4)
Phys 1302W – Physics II (4)
Chem 1062 – Chemical Principles II (3)
Chem 1066 – Chem II Lab (1)
EngW 1101W – Creative Writing (4 cr)

**Sophomore Year**

*Fall Semester (17 cr)*
Math 2374 (2263) – Multivariable Calculus (4)
AEM 2011 – Statics (3)
ESci 2201 – Solid Earth Dynamics I (4)
ESci 2301 – Mineralogy (3)
Liberal education elective (3)

*Spring Semester (15 cr)*
Math 2373 (2243) – Diff Eqns (4)
CE 3101 – Computer Applications I (3)
AEM 3031 – Deform Body Mech (3)
ESci 3891 – Field Methods (2)
Liberal education elective (3)

*Summer Session (4 cr)*
ESci 3911 or ESci 4971W – Field geology (4)

**Junior Year**

*Fall Semester (16 cr)*
GeoE 3301 – Soil Mechanics I (3)
CE 3501 – Environmental Eng (3)
CE 3502 – Fluid Mechanics (4)
ESci 4501 – Structural Geology (3)
Liberal education elective (3)

*Spring Semester (15 cr)*
CE 3102 – Uncertainty (3)
ESci 2302 Petrology (3) (or ESci 2203 Earth Surface Dynamics (4))
AEM 2012– Dynamics (3)
GeoE 4121 – Computer Apps II (3)
GeoE tech elective* (3)

**Senior Year**

*Fall Semester (13 cr)*
GeoE 4311 − Rock Mechanics (4)
GeoE 4351 - Groundwater Mechanics (3.0 cr)
ESci core elective** (3)
Liberal education elective (3)

*Spring Semester (13 cr)*
GeoE 4102W – Capstone Design (4)
GeoE tech elec* (3)
GeoE tech elec* (3)
GeoE tech elec* (3)

14 cr tech elect =

** At least one ESCI course at the 4xxx-level or greater

* At least one course from the following list:
  · GEOE/CE 4301 - Soil Mechanics II (3.0 cr)
  · CE 4501 - Hydrologic Design (4.0 cr)
  · CE 4502 - Water and Wastewater Treatment (3.0 cr)

* Others are chosen by student with guidance from advisor from typically 4*** and/or 5*** courses within CSE

# V. Bachelor of Engineering/Master of Science Integrated Program

**1. B.C.E./M.S. or B.GeoE./M.S.**

The benefit of the Bachelor of Engineering/Master of Science integrated program is that students may be able to streamline the transition from undergraduate to graduate student status, potentially completing their education more quickly. Students may apply for the B.C.E./M.S. or B.GeoE./M.S. integrated program when they are within 32 credits of completing their undergraduate degree. Once admitted, students are able to transfer up to 16 credits of graduate-level courses toward their graduate degree at the cost of undergraduate tuition while completing requirements for both degrees. Students only receive two semesters of a graduate level tuition waiver. If the undergraduate degree is not completed within the two semesters, the remaining tuition will be paid at the graduate level. Both degrees must be completed in their entirety. Graduate classes may not be used as electives for the undergraduate degree, unless the student decides not to complete the M.S. degree. The graduate degree may not be earned before the undergraduate requirements are satisfied. The student should notify the Graduate Studies Secretary once the undergraduate degree is completed. Any questions about the program should be directed to the Graduate Studies Secretary.

**2. Overview**

The B.C.E. /M.S. and B.GeoE./M.S. programs offer civil engineering and geoengineering students:

- Streamlined admissions from the undergraduate to the graduate program (GRE not required);
- Technical elective credits for research performed through independent study (a maximum of 6 credits);
- Flexibility in fulfilling required courses for both degrees simultaneously (up to 16 credits of graduate-level courses can be transferred to the graduate program at undergraduate tuition rates); and
- Eligibility for teaching and research assistantships.

**3. Eligibility Requirements**

1. Enrollment in the civil engineering or geoengineering undergraduate program
2. Within 32 credits of completing the requirements for the bachelor's degree
3. A faculty adviser prior to admission
4. Overall GPA greater than 3.3

**4. Application Procedure**

Students need to complete one applications. The Graduate School application.

Submit to the Graduate School:

1. Completed Graduate School application form
2. Application fee
3. Original transcript

4. Statement of purpose – include in the statement of purpose that the dual degree program is being undertaken
5. Courses needed to complete the B.C.E/B.GeoE. degree requirements and planned graduation semester
6. Planned graduate program for the M.S. degree
7. Three letters of recommendation

**5. Application Deadlines**

Admission will occur twice per year, in the fall and spring semesters. Both applications should be submitted by April 1 for admission the subsequent fall semester, and October 1 for admission the subsequent spring semester.

**6. Financial Support**

Financial support in the form of research and teaching assistantships are available on a competitive basis.

**7. Independent Study**

An undergraduate student in the integrated program can register for CE 4170 (3 credits fall semester) and 4180 (3 credits spring semester) to receive a maximum of six (6) technical elective credits for research performed through independent study. A report on the research conducted during each semester of independent study must be submitted to the faculty adviser for the credits to count towards technical elective requirements.

# VI. Honors Program

**1. Introduction**
The University Honors Program (UHP) serves all undergraduate honors students at the University of Minnesota -Twin Cities, aiding them in their creation of an enriched, interdisciplinary educational experience. Comprising roughly ten percent of the University's undergraduate population, honors students excel both in the classroom and outside of it. Information on the University Honors Program can be found at:
http://honors.umn.edu/about/overview.html

**2. Requirements**
To remain in UHP, Honors students must maintain satisfactory academic standards (including a grade point average of 3.5) and complete a set number of Honors Experiences each year (May and Summer sessions included). Upon completion of these requirements, a yearly "Honors Certification" notation will appear on the student's transcript.

Freshman and sophomore students must complete four Honors Experiences each year. Two of these Honors Experiences must be honors courses or seminars, totaling a minimum of six credits. While the two other experiences may also be courses, students are encouraged to explore other, non-classroom-based options. These options are listed on the Honors Experiences page at http://www.honors.umn.edu/experiences/requirements/.

Junior and senior students must complete three Honors Experiences each year. In the junior year, one honors experience must be a course and the two other experiences may be any combination of courses and non-classroom-based options. In the senior year, students must complete one honors course, another honors course or non-classroom-based option, and an honors thesis. Students work closely with their UHP and faculty advisers to plan for the right combination of research, coursework and community engagement.

**3. Honors Experiences**
UHP recognizes that students are actively engaged inside and outside of the classroom throughout their academic career. The UHP Honors Experience was created to encourage this diversity in educational means and to provide students with flexibility when it comes to choosing an individualized educational path.

Careful attention has been paid to the manner in which Honors Experiences can be fulfilled, as to ensure their substantive educational value while maintaining relevance and ease of integration into the student's major requirements.

Courses
Honors departmental courses and honors seminars make up the vast majority of courses that fulfill Honors Experiences. However, freshmen seminars and Writ 1401 also serve as honors course options. In exceptional circumstances, at the suggestion of an honors adviser, students may contract with a faculty member to enhance a non-honors course in order to gain an Honors Experience.

Non-classroom-based options

Participation in various distinctive, educational experiences may be counted as Honors Experiences. Students looking to fulfill Honors Experiences in this way must complete an Honors Experience Proposal form. Students should discuss this with their honors adviser prior to completing the proposal.

Examples of non-course options include:

- Undergraduate Research Opportunities Program (UROP) projects and other faculty-directed research
- Study abroad experiences*
- Internship experiences*
- Community engagement projects*
- Publication in a recognized scholarly or professional journal
- Poster presentation at a regional or national conference
- Undergraduate tutoring and teaching experiences*

* In order to be approved, these experiences must exhibit significant levels of participation.

Honors Thesis

An Honors Thesis Project is required for graduation with Latin honors at all levels. This project is the culmination of the student's work in research, creative expression, or practicum experience. It must be supervised and approved by a faculty adviser.

# VII. Intern and Cooperative Education (Co-op) Programs

## 1. Intern vs. Co-op

Although the Intern and Co-op programs are commonly referred to in the same breath, they are two different programs.

The Intern program is a non-credit program giving students relevant work experience in an engineering setting with the goal of improving students' educational experiences while strengthening the department's ties to the Minnesota professional engineering community. Through this program, the department helps to locate part-time or summer job opportunities for undergraduate students in civil engineering and geoengineering. The types and responsibility levels for internships vary greatly.

The Co-op program is a full-time 6-month work assignment where credit is earned, which requires the student to register for a course (CE 4190). It is expected that through this full-time work, the student will have an in-depth experience with their employment. At the end of their work assignment the student must write a report and submit it for approval. The Co-op program is open to juniors and seniors majoring in civil engineering or geoengineering at the University of Minnesota who have completed at least one semester in the College of Science and Engineering.

For both the Intern and Co-op programs, it is the responsibility of the student to make contact with their prospective employers. The Department of Civil Engineering facilitates this by seeking out employment opportunities for internships and co-op work experiences. Job listings are kept in a loose-leaf notebook, entitled *Co-op and Intern Job Book*, in the department office (122 CivE) and online at http://www.ce.umn.edu/empopp/listings/. Students are expected to review the notebook, contact prospective employers, and arrange for interviews on their own. Students are asked to notify the office staff when they have accepted a position so the job book can be kept up to date.

## 2. Intern Program

Qualifications

A student's opportunity to be selected for an intern assignment is largely determined by the qualifications presented in their resume and the image projected in their interview. Students are strongly advised to prepare their resume using "Resume Expert Plus," a software package which is available at the University of Minnesota Bookstore in Coffman Memorial Union. Students are also encouraged to visit the Career Center for Science and Engineering (CCSE) in 105 Lind Hall, and to talk to counselors on preparing their resumes and cover letters, interviewing and searching for a job.

Experience has shown that most prospective employers want to hire students who have completed basic civil engineering courses in surveying (CE 3202), soil mechanics (CE 3301), and civil engineering materials (CE 3402), but more advanced coursework is sometimes expected. If a student does not yet meet these qualifications, other opportunities for employment may be available on or off campus. Any such notifications of other employment that the department receives are posted on the bulletin board near the second floor undergraduate study lounge.

## 3. Co-op Program

Qualifications

The Department of Civil Engineering Co-op Program is open to juniors and seniors majoring in civil engineering or geoengineering at the University of Minnesota who have completed at least one semester in the College of Science and Engineering; have cumulative grade point average of 2.0 or higher; are U.S. citizen or permanent resident, or can furnish proof of work authorization to a prospective employer. Similar to the qualifications for internships, a student's opportunity to be selected for a co-op assignment is based on their resume and the image they project in their interview, as well as, completion of basic civil engineering courses.

A student is not officially enrolled in the Co-op program until they have registered for the four-credit course CE 4190, which satisfies a technical elective requirement. Approval to register for CE 4190, in turn, requires that the student prepare a brief statement about the nature of their proposed work assignment on a co-op prospectus (provided in Appendix C).

The normal co-op period is six months. A special two-credit version of CE 4190 is available for students who work for shorter periods, but only in cases for which registration in a course is a condition of employment. A special six-credit version of the course is also available for students whose insurance or loan programs require them to take at least six credits to maintain their student status. At most, four credits from CE 4190 may be used toward a student's B.C.E. or B.GeoE. degree requirements. Students enrolled in the Co-op Program are not eligible to receive department scholarship awards during the semester of their co-op experience because they do not have full-time student status, 12 credits.

Following completion of their work assignment at a location determined by their employer, the co-op student submits a formal report on their co-op experience to the Department of Civil Engineering. Following completion of their co-op assignment, the student must return to structured classroom study at the University. CE 4190 satisfies a technical elective requirement.

Benefits of the Co-op Program

Co-op students are directly involved in various engineering professional activities, working as one of the team. Co-op students become familiar with the professional environment in which they will spend their future years. This productive time challenges and motivates students to complete their education, as well as helps the students discover the wide variety of job opportunities available in civil engineering and geoengineering. Co-op students benefit from this work experience and learn practical aspects of engineering, which cannot realistically be taught in a classroom setting.

Description of Qualifying Co-op Work Opportunities

There are a number of different organizations that offer co-op work opportunities including consulting firms and government agencies. A summary of some of the different areas of emphasis and types of work experiences that may qualify for co-op experience follows.

- *Surveying* – Co-op experiences may involve on-site surveying and evaluation of data required for design of roads, highways, bridges, water and sewer systems, or buildings.

- *Soils and Materials Exploration and Testing* – A co-op assignment may include work in a testing laboratory as well as work in the field, taking soil samples from construction sites and obtaining specimens of materials being used in actual construction.

- *Construction* – The co-op student may serve as an assistant to the construction manager or construction superintendent, or may serve as a construction inspector for projects in which they become involved. The experience may include becoming acquainted with reading and interpreting blueprints, building code requirements, and specifications. In addition, the co-op student may become familiar with various construction methods.

- *Municipal Engineering* – Co-op experiences in municipal engineering may include surveying, planning, design and construction of water mains, storm and sanitary sewers, water towers, and roads, as well as other projects. Co-op assignments may be in a planning office engaged in urban development or transportation planning.

- *Consulting* – The co-op student may serve as an assistant to a consulting engineer or designer in the important initial stages of project development.

Report Requirements

The formal report required for satisfactory completion of CE 4190 is due in the Civil Engineering department office (122 CivE) before 4:30 p.m. on the due date as follows:

Spring/Summer Co-op Period: September 15
Summer/Fall Co-op Period: January 15

The report should be in the form of a letter addressed to Professor Labuz at the department address:

Professor Joseph Labuz
Department of Civil Engineering
University of Minnesota
500 Pillsbury Drive SE
Minneapolis, MN 55455-0116

The body of the report must be *no longer than four pages, double-spaced*; attachments may be provided, but are not required (see below).

In preparing the report, careful attention should be paid to the presentation and style of writing. Students will be required to correct and resubmit your report if it is not prepared to an acceptable standard. The following reference should be consulted for writing style:

> Strunk, W. and E. B. White 1979. The Elements of Style, 4th ed. Boston: Allyn and Bacon.

This book is available at most bookstores (including the University Bookstore) for $9.95 and is well worth the price.

The following items should be covered in the report, at a minimum:

*Background*

- Specifics about the internship (e.g., employer; start and end dates; position held; how position was obtained)
- Nature of job and typical duties performed
- Amount of training and level of supervision provided by employer

*Narrative*

- University courses most beneficial to co-op work and why
- List two or three of the most important things learned during co-op assignment, and why they were important
- Discuss how co-op experience affected plans for remaining study, as well as career plans as a civil engineer.

*Conclusion*

- Summarize co-op experience in no more than 50 words.

*Attachments (optional)*

- A sample of work product (e.g., plans, drawings, reports) prepared substantially by you or under your direction.

For Questions regarding the Intern or Co-op Program, please contact Professor Joseph Labuz.

# 4. Instructions for Intern and Co-op Students Applying for Jobs

1. Buy a copy of "Resume Expert Plus" (at the University of Minnesota Bookstore in Coffman Memorial Union) and use it to prepare your resume. Highly recommended (but optional): Visit the Career Center for Science and Engineering (CCSE) in 105 Lind Hall, and talk to counselors on preparing resumes and cover letters, interviewing, and searching for a job.

2. Check the *Co-op and Intern Job Book* in the department office (122 CivE) and the department website (http://www.ce.umn.edu/empopp/listings/). New job opportunities come in mostly during the beginning of spring semester and sporadically after that. The department and the American Society of Civil Engineers (ASCE) Student Chapter hosts a career fair in fall semester, where 25-30 company representatives are invited to the campus interested in hiring interns, co-op students and graduating seniors. Also, watch the notice board adjacent to the second floor student lounge and study area. The department tries to keep students informed regarding the influx of new job opportunities.

3. When you see a job that interests you, check the information from the employer on:
   - Type of employment
   - Location
   - Dates and hours of employment
   - Need for providing your own transportation

4. Unless the application instructions are clear from the employer's forms or information, telephone the employer contact person as soon as possible. He or she will tell you how to proceed with submitting your application and arranging for an interview.

5. If you decide later not to pursue the job, let the employer contact person know in time for him or her to schedule interviews with other students. To just drop out without telling anyone creates a bad impression of you and the department, and also hurts the chances for other students to get jobs.

6. Show up for your interview on time.

7. If you take a job, notify the department (122 CivE, 612-625-5522) so that our records can be kept up to date. This step is important so that other students do not pursue false leads, and so that your new employer will not be contacted unnecessarily.

8. If your job is for a 6-month period and you want to enroll in the Civil Engineering Co-op Program, fill out the co-op prospectus form found in Appendix C. Upon approval of your co-op opportunity by Professor Labuz, you will be permitted to enroll in the 4-credit course CE 4190. Remember that you are not officially a co-op student until you register for this course!

9. If you have any questions, please contact the department office (122 CivE) or 612-625-5522.

# VIII. Employment Opportunities for Graduating Students

**1. Department of Civil Engineering Resources**
The department receives information on permanent job opportunities for civil engineering and geoengineering graduates. These positions are posted on the bulletin board in the second floor undergraduate lounge. In addition, the faculty and staff pass on requests via e-mail received by potential employers. The department and the American Society of Civil Engineers (ASCE) Minnesota Student Chapter hosts a career fair typically fall semester, where they invite a number of company representatives to the department interested in hiring our students. Typical attendance has been 25-30 companies and 150-200 students.

**2. Center for Transportation Studies (CTS) Resources**
The University of Minnesota Center for Transportation Studies presents an annual Career Expo early spring semester. The objective of the event is to facilitate connections between students and prospective employers in transportation-related fields. Attendees include representatives from planning, supply chain management, logistics, marketing, and engineering.

**3. Career Center for Science and Engineering (CCSE) Resources**
Students are encouraged to become familiar with CCSE and its functions. A wide variety of employers representing local, state, and national organizations visits each year. The office schedules interviews and maintains a library with information on prospective employers. CCSE is located in 105 Lind Hall; phone 612-624-4090. The website is http://www.ccse.umn.edu/.

# IX. Scholarships and Awards

**1. Scholarships**

The Department of Civil, Environmental, and Geo- Engineering awards a significant number of scholarships totaling more than $100,000. While many of these awards are based on academic achievement, some are based on a student's participation in university and community activities and her/his potential for pursuing a successful career as a practicing engineer after graduation.

Even though these scholarships are normally awarded to upper division students who have declared a departmental major, lower division students who have a demonstrated interest in civil engineering or geoengineering can apply. Applications will be available in January for awards for the following academic year. All scholarship recipients must be enrolled full-time, at least 12 credits. Students who are enrolled in the Civil Engineering Co-op Program are not eligible for scholarships during the semester of their co-op experience because they are not enrolled full-time. Information on the department scholarships and external scholarships for which our students are eligible may be found at http://www.ce.umn.edu/undergrad/scholar.html.

**2. Awards**

The Department of Civil, Environmental, and Geo- Engineering has the following student awards:

- *The Claire and Simon Benson Award* - the department annually presents this award to undergraduate students who show outstanding performance. Faculty nominates undergraduate students for this award. A cash award is also included with this award.
- *Chester D. Okerlund Award* - This award is annually presented to the student with the highest grade point average in the Department of Civil Engineering graduating class. A cash award is also included with this award.
- *ASCE* - The Minnesota Section of ASCE holds an annual spring banquet to recognize scholarship recipients and to present student awards. ASCE sponsors the Archie & Marie Carter Scholarship that is awarded to a civil engineering student who is an active member of the student chapter, strong academically, and a Minnesota resident. ASCE also presents the ASCE Student Activity Award and the ASCE Outstanding Student Award.

# X. Civil Engineering, Environmental Engineering, and Geoengineering Societies and Student Activities

**1. Chi Epsilon**

Chi Epsilon is the National Civil Engineering Honor Society, and it seeks to promote the values of Scholarship, Character, Practicality, and Sociability in its members and the profession of civil engineering. To be invited to join, civil engineers must have at least junior standing, and be ranked in the top third of their class academically. The Minnesota Chapter of Chi Epsilon was chartered in 1923 as the third chapter. Today, Chi Epsilon consists of over 120 chapters.

The objectives of the Minnesota Chapter are to maintain and promote the status of civil engineering as an ideal profession, to bestow honor upon civil engineering juniors, seniors and graduate students who have demonstrated exceptional scholarship, and to develop the qualities of character, practicality and sociability in each member of the chapter. In order to carry out these objectives, the Chapter has organized and participated in a number of different activities over the years, including organizing the order of the engineer ceremony and going to grade schools and high schools to perform engineering demonstrations.

**2. American Society of Civil Engineers (ASCE)**

ASCE is the oldest professional engineering organization in the country. ASCE promotes leadership, community service, and networking for all of its members. The officers of the ASCE Student Chapter accomplish this through seminars, luncheons, socials, and a career fair. The ASCE Student Chapter is involved in many projects; two of the most popular are the Concrete Canoe Competition and the Steel Bridge Design Team. In the Concrete Canoe Competition, team members test, design, and manufacture super-lightweight concretes that are state of the art. These new materials have excellent potential to be used in all types of projects including buildings, dams, marinas, and other moisture sensitive areas. The Steel Bridge Team designs, creates, and assembles a bridge to compete in regional and national competitions. The design process starts in the fall when the team receives the specifications for the event. Construction starts in winter and the competition is usually held in mid-February. At the competition, the bridge is graded on how quickly it can be assembled, the total weight, and the deflection under loading. ASCE offers its members many opportunities; the Department of Civil, Environmental, And Geo- Engineering encourages students to join this organization on the local, state and national levels. For more information visit the student chapter website at http://www.tc.umn.edu/~asce/

**3. Order of the Engineer**

The Order of the Engineer initiated at Cleveland State University on June 4, 1970 and has spread nationwide. The goal of the Order is the same as that of the Canadian "Ritual of the Calling of an Engineer," acceptance of the Obligation of an Engineer: the development of pride in the profession of engineering and the upholding of the standards and dignity of the profession.

This oath is recognized by the engineer wearing of a steel band around the fifth finger of the working hand. Graduating seniors in the Department of Civil Engineering have the opportunity to join the Order of the Engineer.

Please contact Professor Joe Labuz with any questions regarding Order of the Engineer.

**4. Society for Mining, Metallurgy, and Exploration (SME)**
The Society for Mining, Metallurgy, and Exploration is the world's largest society of minerals professionals. The SME advances the worldwide mining and minerals community through information exchange and professional development. SME is a professional society that promotes interest in mining, metallurgy, and exploration within the university. The student chapter activities include monthly guest speaker meetings, local field trips (nearby mine sites), and social events. Students are also encouraged to become involved with the local professional technical community which provides tremendous opportunities for networking. Goals of the Minnesota Section of SME include promoting and developing future careers in the industry through scholarships, internships, and involvement with educational institutions. The website for the student organization is https://www.sites.google.com/site/umnsme/ and the website for the Minnesota Section of SME is http://www.smetwincities.org/.

# XI. Health and Wellness

**1. Aurora Center**
The Aurora Center provides a safe and confidential space for students, faculty, staff, alumni, and family members or friends affiliated with the University of Minnesota, TC or Augsburg College who are victims/survivors/concerned people of sexual assault, relationship violence, or stalking.

**2. Disability Services**
The University of Minnesota has a number of resources available for its diverse student population. One of these resources is Disabilities Services, which serves students who may have either temporary or permanent disabilities. Services include note taking assistance, document conversion, extra examination time or special room arrangements. Students may be tested to determine if they are eligible. Questions regarding these programs should be directed to the disability specialists at https://diversity.umn.edu/disability/intakeprocess

**3. Mental Health Services**
Painful feelings such as anxiety, anger, depression, low self-esteem, and tension are a normal part of being human and can affect anyone. Sometimes these feelings are temporary and can be eased by rest, relaxation, exercise, good nutrition, and support of trusted friends. At other times, stressors, relationships, or past family experiences cannot be managed so easily and become overwhelming. When this happens, and you find it hard to function, you may want to seek professional help.

Boynton's mental health staff of psychiatrists, licensed psychologists, and licensed independent clinical social workers provides a variety of counseling options which can be found at http://www.bhs.umn.edu/east-bank-clinic/mental-health-services.htm

Call the direct line for the Urgent Mental Health Consultation at 612-625-8475. If the counselor is available, the phone will be answered directly. If the counselor is busy or seeing another student, please leave a message. The line is confidential. For emergencies, call **9-1-1**.

**4. Medical Services**
Boynton's East Bank Clinic is one of the most comprehensive postsecondary health services in the nation. With a staff of over 200, the East Bank Clinic houses several individual clinics including Dental, Eye, Massage Therapy, Mental Health, Nutrition, Physical Therapy, Primary Care, Women's, Travel Immunization, and Urgent Care. The East Bank Clinic is also home to a full-service Pharmacy and offers health and wellness services.

Boynton's East Bank Clinic staff includes licensed and certified physicians, physician assistants, nurse practitioners, registered nurses, licensed practical nurses, certified medical assistants, optometrists, dentists, dental hygienists, mental health care providers (including psychiatrists, psychologists, and social workers), physical and massage therapists, registered dietitians, and pharmacists. For more information refer to http://www.bhs.umn.edu/east-bank-clinic/. For emergencies, call **9-1-1**.

**5. University Counseling & Consulting Services**

University Counseling & Consulting Services promotes student success through individual and group counseling; classes, workshops, and presentations; and consultation. Services address a wide range of issues impacting student success, including mental health and life concerns, learning and academic skills challenges, faculty/staff-student communication, and career uncertainty. For more information please refer to **http://www.uccs.umn.edu/**.

# XII. Emergency and Security Procedures

Please review the following emergency and security procedures. If you have any questions, contact the Department of Civil, Environmental, and Geo- Engineering staff in room 122 CivE or telephone: 612-625-5522.

**Chemical Spills**

Contact: Kathy Wabner, Civil Engineering Health & Safety Officer
149 Civil Engineering Building, 612-625-1125
After Hours: Emergency Response call Facilities Management, 612-625-0011
If life threatening dial **9-1-1**
Spill Kits: Currently none available. See Kathy Wabner about spills.

**Closing Offices**

Only the President or one of his designates can close the University. University Relations has the responsibility to notify the campus community and the public if the University is to be closed.

**Emergency Procedures**

Contact: University Police (**9-1-1** in emergencies, 612-624-2677 in non-emergencies). In case of fire or medical emergency, position someone outside the building to lead ambulance or fire personnel to the emergency location.

Fire Emergencies

Elevators will shut down automatically when there is a fire alarm. All employees should familiarize themselves with fire exits, stairwells and extinguishers located in the building. Evacuate the building immediately when a fire alarm is sounded and do not return until the fire department has approved re-entry into the building. There are refuge areas located on the 4th floor landing in the main stairwell and the 4th and 5th floor landings in the east stairwell. Report the use of fire extinguishers so they can be inspected and refilled.

Injuries

If an employee is injured on the job, the supervisor is responsible for notifying the department administrator and obtaining a "Report of Incident" form to complete. This form must be completed within 24 hours of the injury. Failure to comply may result in loss of Worker's Compensation Rights and a fine levied against the department.

TXT-U

TXT-U is the University's emergency notification text messaging system. Students with an active Internet ID and University of Minnesota email address are automatically added to the TXT-U system. However, only those with cell phone numbers included in their University personal information will receive emergency text messages. To be sure you will receive TXT-U

messages in an emergency, verify your information by going to your http://www1.umn.edu/prepared/txtu/.

**Minnesota Employee Right to Know Act (MERTKA)**
All new graduate students and employees of the Department of Civil Engineering are required to attend safety-training sessions, follow safety guidelines, and read the "*Laboratory Safety Plan*" before working in any laboratory. Copies of the "*Lab Safety Plan*" are available online. http://www.ce.umn.edu/about_us/building_and_lab_safety_documents/index.html

**Safety/Security**
Building Hours
The Civil Engineering Building is open from 7:00 a.m. until 10:00 p.m. For laboratory safety and security, authorized personnel are asked to use a buddy system when working in the Civil Engineering Building after hours. Authorized personnel and custodial staff are asked to report unusual incidents or unauthorized people to the University Police.

Emergency Telephones
Special automatic dial security telephones are located in the elevators, hallways on the 6th and 7th floor, and in the refuge areas in the main stairwell and the east stairwell.

Escort Service
The University offers free walking and biking security escorts 365 days a year to and from campus and adjacent neighborhoods. Contact 612-624-WALK (9255) to request a security escort.

**Threats & Violence**
For any threat call **9-1-1** for police assistance if you observe violence taking place or believe/feel there is an immediate threat to someone's safety. All faculty, staff, and student workers should communicate to an administrator/supervisor any knowledge of violence or threat related behaviors including possession of a weapon in the workplace. Students and other non-workers should call **9-1-1**.

# Appendix A
# Civil Engineering – Preapproved and Recommended Technical Electives

| Courses | Title | Environ. | Geomech. | Struct. | Transp. | Water Res. | Infrastr. Policy |
|---|---|---|---|---|---|---|---|
| CE 1101 | Civil Engineering Orientation | | | | | | |
| CE 3111 | CADD | | X | | X | | |
| CE 3202 | Surveying & Mapping | | X | | X | | |
| CE/GEOE 4111 | Systems Analysis | | X | | X | | X |
| CE/GEOE 4121 | Computer Apps II | | X | | X | | |
| CE 4201 | Highway Design | | | | X | | |
| CE 4211 | Traffic Engineering | | | | X | | |
| CE 4251 | Pavement Analysis | | | | X | | |
| CE 4253 | Pavement Engineering | | | | X | | |
| CE/GEOE 4311 | Rock Mechanics | | X | | | | |
| CE/GEOE 4341 | Engineering Geostatistics | | X | | | | |
| CE/GEOE 4351 | Groundwater Mechanics | | X | | | | |
| CE/GEOE 4352 | Groundwater Modeling | | X | | | | |
| CE 4411 | Matrix Analysis of Structures | | | X | | | |
| CE 4412 | Reinforced Concrete Design II | | | X | | | |
| CE 4413 | Steel Design II | | | X | | | |
| CE 4511 | Hydraulic Structures | | | | | X | |
| CE 4512 | Open Channel Hydraulics | | | | | X | |
| CE 4561 | Solid and Hazardous Waste | X | | | | | |
| CE 4562 | Environmental Remediation Technology | X | | | | | |
| CE 5211 | Traffic Engineering | | | | | X | X |
| CE 5212 | Trans. Policy, Plan, & Deploy | | | | X | | X |
| CE 5214 | Transportation Systems Analysis | | | | X | | X |
| CE 5253 | Asphalt and Portland Cement Concrete | | | | X | | |
| CE/GEOE 5311 | Experimental Geomechanics | | X | X | | | |
| GEOE/CE 5321 | Geomechanics | | X | | | | |
| GEOE/CE 5331 | Geomechanics Modeling | | X | | | | |
| CE/GEOE 5341 | Wave Methods | | X | | | | |
| CE 5351 | Advanced Mathematics for Civil Engineers | | X | X | X | | |
| CE 5411 | Applied Structural Mechanics | | | X | | | |
| CE 5414 | Prestressed Concrete Design | | | X | | | |
| CE 5415 | Masonry Structures | | | X | | | |
| CE 5511 | Urban Hydrology | | | | | X | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| CE 5541 | Environmental Water CHEMistry | X | | | | | |
| CE 5542 | Experimental Methods in Environmental Engineering | X | | | | | |
| CE 5551 | Environmental Microbiology | X | | | | | |
| CE 5552 | Environmental Microbiology Lab | X | | | | | |
| CE 5561 | Air Quality Engineering | X | | | X | | X |
| CE 5571 | Design for Sustainable Development | X | | | X | | X |
| *CE/GEOE 4000H* | *Honors Research Seminar* | X | X | X | X | X | X |
| *CE/GEOE 4011* | *Special Topics* | X | X | X | X | X | X |
| *CE/GEOE 4092H* | *Honors Selected Reading* | X | X | X | X | X | X |
| *CE/GEOE 4094H* | *Senior Honors Thesis* | X | X | X | X | X | X |
| *CE 4170* | *Independent Study I* | X | X | X | X | X | X |
| *CE 4180* | *Independent Study II* | X | X | X | X | X | X |
| *CE 4190* | *Engineering Co-op Assignment* | X | X | X | X | X | X |
| *CE/GEOE 4194H* | *Senior Honors Thesis* | X | X | X | X | X | X |
| *CE 5094* | *Civil Engineering Research* | X | X | X | X | X | X |
| *CE 5180* | *Special Topics* | X | X | X | X | X | X |
| AEM 4501 | Aerospace Structures | | | X | | | |
| AEM 4502 | Computational Structural Analysis | | | X | | | |
| AEM 4511 | Mechanics of Composite Materials | | | X | | | |
| AEM 4581 | Mechanics of Solids | | X | X | | | |
| AEM 5501 | Continuum Mechanics | | X | | | | |
| AEM 5503 | Theory of Elasticity | | X | | | | |
| BBE 3407 | Ecology | X | | | | | |
| BBE 4301 | Applied Surface and Colloid Science | X | | | | | |
| BBE 4523 | Ecological Engineering Design | X | | | | | |
| BBE 4733 | Renewable Energy Technologies (TS) | X | | | | | |
| BIOL 3407 | Ecology | X | | | | | |
| CHEM 2301 | Organic Chemistry I | X | | | | | |
| CHEN 4102 | Reaction Kinetics and Reactor Engineering | X | | | | | |
| CMGT | Any 4xxx course | | | | | | |
| CSCI 1001 | Overview of Computer Science | | | | X | | |
| CSCI 1103 | Introduction to Computer Programming in Java | | | | X | | |
| CSCI 1113 | Introduction to C/C++ Programming for Scientists and Engineers | | | | X | | |
| CSCI 4203 | Computer Architecture | | | | X | | |
| CSCI 4707 | Practice of Database Systems | | | | X | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| EE 2001 | Introduction to circuits and electronics | | | | X | | |
| EEB5601 | Limnology | X | | | | | |
| ESCI 4203 | Principles of Geophysical Exploration | | X | | | | |
| ESCI 4501 | Structural Geology | | X | | | | |
| ESCI 4602 | Sedimentology and Stratigraphy | | X | | | | |
| ESCI 4701 | Geomorphology | | X | | | | |
| ESCI 4702 | General Hydrogeology | | X | | | | |
| ESCI 4703 | Glacial Geology | | X | | | | |
| ESCI 4971 | Field Hydrogeology | | X | | | | |
| ESCI 5204 | Geostatistics and Inverse Theory | | X | | | | |
| ESCI 5713 | Tracers and Karst Hydrogeology | | X | | | | |
| ESPM 3505 | General Hydrogeology | X | | | | | |
| ESPM 5605 | Recycling: Extending Raw Materials Supplies | X | | | | | |
| ESPM 3606 | Pollution Prevention: Principles, Technologies, and Practices | X | | | | | |
| ESPM 5606 | Pollution Prevention: Principles, Technologies, and Practices | X | | | | | |
| FNRM 3131 | Geographical Information Systems (GIS) for Natural Resources | X | X | | X | | X |
| GEOG 3561 | Principles of Geographic Information Science | | | | X | | X |
| GEOG 3531 | Numerical Spatial Analysis | | | | X | | X |
| GEOG 3523 | Digital Mapping: Introduction to Making Online Maps for… | | | | X | | X |
| GEOG 5563 | Advanced Geographic Information Science | | | | X | | X |
| GEOG 5564 | Urban Geographic Information Science and Analysis | | | | X | | X |
| IE 5111 | Systems Engineering I | | | | X | | X |
| IE 5112 | Introduction to Operations Research | | | | X | | |
| IE5531 | Engineering Optimization I | | | | X | | |
| IE 4521 | Statistics, Quality, and Reliability | | | | X | | |
| IE 5545 | Decision Analysis | | | | X | | X |
| IE 5553 | Simulation | | | | X | | |
| MATH 4242 | Applied Linear Algebra | | X | X | | X | |
| MATH 4428 | Mathematical Modeling | | X | X | | X | |
| MATH 4512 | Differential Equations with Applications | | X | X | | X | |
| MATH 4567 | Applied Fourier Analysis | | X | X | | X | |
| MATH 5485 | Introduction to Numerical Methods I | | X | X | | X | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| MATH 5486 | Introduction to Numerical Methods II | | X | X | | X | |
| MATH 5583 | Complex Analysis | | X | X | | X | |
| MATH 5587 | Elementary Partial Differential Equations I | | X | X | | X | |
| MATH 5588 | Elementary Partial Differential Equations II | | X | X | | X | |
| MATS 2001 | Introduction to the Science of Engineering Materials | | | | | | |
| ME 3331 | Thermal Sciences I | | | | | | |
| ME 5228 | Introduction to Finite Element Modeling, Analysis and Design | | | X | | | |
| ME 5247 | Stress Analysis, Sensing and Transducers | | | X | | | |
| ME 5248 | Vibration Engineering | | | X | | | |
| MICB 3301 | Biology of Microorganisms | X | | | | | |
| PA 4200 | Urban and Regional Planning | | | | X | | X |
| PA 5013 | Law and Urban Land Use | | | | X | | X |
| PA 5204 | Urban Spatial and Social Dynamics | | | | X | | X |
| PA 5231 | Transit Planning and Management | | | | X | | X |
| STAT 5021 | Statistical Analysis | | | | X | | X |
| STAT 5302 | Applied Regression Analysis | | | | X | | X |
| WRS 5101 | Water Policy | X | | | | | X |

# Appendix B
# Environmental Engineering – Preapproved and Recommended Technical Electives

| Courses | Title | Environ. | Geomech. | Struct. | Transp. | Water Res. | Infrastr. Policy |
|---|---|---|---|---|---|---|---|
| CE 1101 | Civil Engineering Orientation | | | | | | |
| CE 3111 | CADD | | X | | X | | |
| CE 3202 | Surveying & Mapping | | X | | X | | |
| CE/GEOE 4111 | Systems Analysis | | X | | X | | X |
| CE/GEOE 4121 | Computer Apps II | | X | | X | | |
| CE 4201 | Highway Design | | | | X | | |
| CE 4211 | Traffic Engineering | | | | X | | |
| CE 4251 | Pavement Analysis | | | | X | | |
| CE 4253 | Pavement Engineering | | | | X | | |
| CE/GEOE 4311 | Rock Mechanics | | X | | | | |
| CE/GEOE 4341 | Engineering Geostatistics | | X | | | | |
| CE/GEOE 4351 | Groundwater Mechanics | X | X | | | | |
| CE/GEOE 4352 | Groundwater Modeling | X | X | | | | |
| CE 4411 | Matrix Analysis of Structures | | | X | | | |
| CE 4412 | Reinforced Concrete Design II | | | X | | | |
| CE 4413 | Steel Design II | | | X | | | |
| CE 4511 | Hydraulic Structures | | | | | X | |
| CE 4512 | Open Channel Hydraulics | X | | | | X | |
| CE 4561 | Solid and Hazardous Waste | X | | | | | |
| CE 4562 | Environmental Remediation Technology | X | | | | | |
| CE 5211 | Traffic Engineering | | | | | X | X |
| CE 5212 | Trans. Policy, Plan, & Deploy | | | | X | | X |
| CE 5214 | Transportation Systems Analysis | | | | X | | X |
| CE 5253 | Asphalt and Portland Cement Concrete | | | | X | | |
| CE/GEOE 5311 | Experimental Geomechanics | | X | X | | | |
| GEOE/CE 5321 | Geomechanics | | X | | | | |
| GEOE/CE 5331 | Geomechanics Modeling | | X | | | | |
| CE/GEOE 5341 | Wave Methods | | X | | | | |
| CE 5351 | Advanced Mathematics for Civil Engineers | | X | X | X | | |
| CE 5411 | Applied Structural Mechanics | | | X | | | |
| CE 5414 | Prestressed Concrete Design | | | X | | | |
| CE 5415 | Masonry Structures | | | X | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| CE 5511 | Urban Hydrology | | | | | X | |
| CE 5541 | Environmental Water CHEMistry | X | | | | | |
| CE 5542 | Experimental Methods in Environmental Engineering | X | | | | | |
| CE 5551 | Environmental Microbiology | X | | | | | |
| CE 5552 | Environmental Microbiology Lab | X | | | | | |
| CE 5561 | Air Quality Engineering | X | | | X | | X |
| CE 5571 | Design for Sustainable Development | X | | | X | | X |
| *CE/GEOE 4000H* | *Honors Research Seminar* | X | X | X | X | X | X |
| *CE/GEOE 4011* | *Special Topics* | X | X | X | X | X | X |
| *CE/GEOE 4092H* | *Honors Selected Reading* | X | X | X | X | X | X |
| *CE/GEOE 4094H* | *Senior Honors Thesis* | X | X | X | X | X | X |
| *CE 4170* | *Independent Study I* | X | X | X | X | X | X |
| *CE 4180* | *Independent Study II* | X | X | X | X | X | X |
| *CE 4190* | *Engineering Co-op Assignment* | X | X | X | X | X | X |
| *CE/GEOE 4194H* | *Senior Honors Thesis* | X | X | X | X | X | X |
| *CE 5094* | *Civil Engineering Research* | X | X | X | X | X | X |
| *CE 5180* | *Special Topics* | X | X | X | X | X | X |
| AEM 4501 | Aerospace Structures | | | X | | | |
| AEM 4502 | Computational Structural Analysis | | | X | | | |
| AEM 4511 | Mechanics of Composite Materials | | | X | | | |
| AEM 4581 | Mechanics of Solids | | X | X | | | |
| AEM 5501 | Continuum Mechanics | | X | | | | |
| AEM 5503 | Theory of Elasticity | | X | | | | |
| BBE 3407 | Ecology | X | | | | | |
| BBE 4301 | Applied Surface and Colloid Science | | | | | | |
| BBE 4523 | Ecological Engineering Design | X | | | | | |
| BBE 4533 | Sustainable Waste Management Engineering | X | | | | | |
| BBE 4733 | Renewable Energy Technologies (TS) | X | | | | | |
| CHEM 2301 | Organic Chemistry I | X | | | | | |
| CHEN 4102 | Reaction Kinetics and Reactor Engineering | X | | | | | |
| CMGT | Any 4xxx course | | | | | | |
| CSCI 1001 | Overview of Computer Science | | | | X | | |
| CSCI 1103 | Introduction to Computer Programming in Java | | | | X | | |
| CSCI 1113 | Introduction to C/C++ Programming for Scientists and Engineers | | | | X | | |
| CSCI 4203 | Computer Architecture | | | | X | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| CSCI 4707 | Practice of Database Systems | | | | X | | |
| EE 2001 | Introduction to circuits and electronics | | | | X | | |
| EEB5601 | Limnology | X | | | | | |
| ESCI 4203 | Principles of Geophysical Exploration | | X | | | | |
| ESCI 4501 | Structural Geology | | X | | | | |
| ESCI 4602 | Sedimentology and Stratigraphy | | X | | | | |
| ESCI 4701 | Geomorphology | | X | | | | |
| ESCI 4702 | General Hydrogeology | | X | | | | |
| ESCI 4703 | Glacial Geology | | X | | | | |
| ESCI 4971 | Field Hydrogeology | | X | | | | |
| ESCI 5204 | Geostatistics and Inverse Theory | | X | | | | |
| ESCI 5713 | Tracers and Karst Hydrogeology | | X | | | | |
| ESPM 3505 | General Hydrogeology | X | | | | | |
| ESPM 5605 | Recycling: Extending Raw Materials Supplies | X | | | | | |
| ESPM 3606 | Pollution Prevention: Principles, Technologies, and Practices | X | | | | | |
| ESPM 5606 | Pollution Prevention: Principles, Technologies, and Practices | X | | | | | |
| FNRM 3131 | Geographical Information Systems (GIS) for Natural Resources | X | X | | X | | X |
| GEOG 3561 | Principles of Geographic Information Science | | | | X | | X |
| GEOG 3531 | Numerical Spatial Analysis | | | | X | | X |
| GEOG 3523 | Digital Mapping: Introduction to Making Online Maps for… | | | | X | | X |
| GEOG 5563 | Advanced Geographic Information Science | | | | X | | X |
| GEOG 5564 | Urban Geographic Information Science and Analysis | | | | X | | X |
| IE 5111 | Systems Engineering I | | | | X | | X |
| IE 5112 | Introduction to Operations Research | | | | X | | |
| IE5531 | Engineering Optimization I | | | | X | | |
| IE 4521 | Statistics, Quality, and Reliability | | | | X | | |
| IE 5545 | Decision Analysis | | | | X | | X |
| IE 5553 | Simulation | | | | X | | |
| MATH 4242 | Applied Linear Algebra | | X | X | | X | |
| MATH 4428 | Mathematical Modeling | | X | X | | X | |
| MATH 4512 | Differential Equations with Applications | | X | X | | X | |
| MATH 4567 | Applied Fourier Analysis | | X | X | | X | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| MATH 5485 | Introduction to Numerical Methods I | | X | X | | X | |
| MATH 5486 | Introduction to Numerical Methods II | | X | X | | X | |
| MATH 5583 | Complex Analysis | | X | X | | X | |
| MATH 5587 | Elementary Partial Differential Equations I | | X | X | | X | |
| MATH 5588 | Elementary Partial Differential Equations II | | X | X | | X | |
| MATS 2001 | Introduction to the Science of Engineering Materials | | | | | | |
| ME 3331 | Thermal Sciences I | | | | | | |
| ME 5228 | Introduction to Finite Element Modeling, Analysis and Design | | | X | | | |
| ME 5247 | Stress Analysis, Sensing and Transducers | | | X | | | |
| ME 5248 | Vibration Engineering | | | X | | | |
| MICB 3301 | Biology of Microorganisms | X | | | | | |
| PA 4200 | Urban and Regional Planning | | | | X | | X |
| PA 5013 | Law and Urban Land Use | | | | X | | X |
| PA 5204 | Urban Spatial and Social Dynamics | | | | X | | X |
| PA 5231 | Transit Planning and Management | | | | X | | X |
| STAT 5021 | Statistical Analysis | | | | X | | X |
| STAT 5302 | Applied Regression Analysis | | | | X | | X |
| WRS 5101 | Water Policy | X | | | | | X |

# Appendix C
# Geoengineering - Preapproved and Recommended Technical Electives

| Courses | Title | Geo-environmental | Georesources | Geofluids |
|---|---|---|---|---|
| CE 1101 | Civil Engineering Orientation | X | X | X |
| CE 3111 | CADD | | X | |
| CE 3202 | Surveying & Mapping | | X | |
| CE 3402 | Civil Engineering Materials | X | X | X |
| GEOE/CE 4111 | Systems Analysis | | X | |
| CE 4301 | Soil Mechanics II | | X | |
| GEOE/CE 4341 | Engineering Geostatistics | | X | |
| GEOE/CE 4351 | Groundwater Mechanics | | X | |
| GEOE/CE 4352 | Groundwater Modeling | | X | |
| CE 4501 | Hydrologic Design | | | X |
| CE 4502 | Water and Wastewater Treatment | X | | X |
| CE 4511 | Hydraulic Structures | | | X |
| CE 4512 | Open Channel Hydraulics | | | X |
| CE 4561 | Solid and Hazardous Waste | X | | |
| CE 4562 | Environmental Remediation Technology | X | | |
| GEOE/CE 5311 | Experimental Geomechanics | | X | |
| GEOE 5321 | Geomechanics | | X | |
| GEOE 5331 | Geomechanics Modeling | | X | |
| GEOE/CE 5341 | Wave Methods | | X | |
| GEOE/CE 5351 | Advanced Mathematics for Civil Engineers | | X | |
| CE 5511 | Urban Hydrology | | | X |
| CE 5541 | Environmental Water CHEMistry | X | | |
| CE 5542 | Experimental Methods in Environmental Engineering | X | | |
| CE 5551 | Environmental Microbiology | X | | |
| CE 5552 | Environmental Microbiology Lab | X | | |
| CE 5561 | Air Quality Engineering | X | | |
| CE 5571 | Design for Sustainable Development | X | | |
| *GEOE/CE 4000H* | *Honors Research Seminar* | X | X | X |
| *GEOE/CE 4011* | *Special Topics* | X | X | X |
| *GEOE/CE 4092H* | *Honors Selected Reading* | X | X | X |
| *GEOE/CE 4094H* | *Senior Honors Thesis* | X | X | X |
| *CE 4170* | *Independent Study I* | X | X | X |
| *CE 4180* | *Independent Study II* | X | X | X |

| | | | | |
|---|---|---|---|---|
| *CE 4190* | *Engineering Co-op Assignment* | X | X | X |
| *GEOE/CE 4194H* | *Senior Honors Thesis* | X | X | X |
| *CE 5094* | *Civil Engineering Research* | X | X | X |
| *CE 5180* | *Special Topics* | X | X | X |
| AEM 4511 | Mechanics of Composite Materials | | X | |
| AEM 4581 | Mechanics of Solids | | X | |
| AEM 5501 | Continuum Mechanics | | X | |
| AEM 5503 | Theory of Elasticity | | X | |
| BBE 3407 | Ecology | X | | |
| BBE 4301 | Applied Surface and Colloid Science | X | | |
| BBE 4523 | Ecological Engineering Design | X | | |
| BBE 4533 | Sustainable Waste Management Engineering | X | | |
| BBE 4733 | Renewable Energy Technologies (TS) | X | | |
| CHEN 4102 | Reaction Kinetics and Reactor Engineering | X | | |
| EEB5601 | Limnology | X | | |
| ESCI 4203 | Principles of Geophysical Exploration | | X | |
| ESCI 4602 | Sedimentology and Stratigraphy | | X | |
| ESCI 4701 | Geomorphology | | X | |
| ESCI 4702 | General Hydrogeology | | X | |
| ESCI 4703 | Glacial Geology | | X | |
| ESCI 4971 | Field Hydrogeology | | X | |
| ESCI 5204 | Geostatistics and Inverse Theory | | X | |
| ESCI 5205 | Fluid Mechanics in Earth and Environmental Sciences | X | | X |
| ESCI 5713 | Tracers and Karst Hydrogeology | | X | |
| ESPM 3505 | General Hydrogeology | X | | X |
| ESPM 5605 | Recycling: Extending Raw Materials Supplies | X | | |
| ESPM 3606 | Pollution Prevention: Principles, Technologies, and Practices | X | | |
| ESPM 5606 | Pollution Prevention: Principles, Technologies, and Practices | X | | |
| FNRM 3131 | Geographical Information Systems (GIS) for Natural Resources | X | X | |
| MATH 4242 | Applied Linear Algebra | | X | X |
| MATH 4428 | Mathematical Modeling | | X | X |
| MATH 4512 | Differential Equations with Applications | | X | X |
| MATH 4567 | Applied Fourier Analysis | | X | X |
| MATH 5485 | Introduction to Numerical Methods I | | X | X |
| MATH 5486 | Introduction to Numerical Methods II | | X | X |
| MATH 5583 | Complex Analysis | | X | X |

| | | | | |
|---|---|---|---|---|
| MATH 5587 | Elementary Partial Differential Equations I | | X | X |
| MATH 5588 | Elementary Partial Differential Equations II | | X | X |
| ME 5228 | Introduction to Finite Element Modeling, Analysis and Design | | X | |
| MICB 3301 | Biology of Microorganisms | X | | |
| WRS 5101 | Water Policy | X | | |

# Appendix D

## Department of Civil, Environmental, and Geo- Engineering Co-op Prospectus

*Please attach a copy of your resume and current transcript.*

Name: _____
(Last) (First) (Middle Initial)

Address: _____

_____

_____

_____

Telephone: _____ Email: _____

Employer name and address:

_____

_____

_____

_____

Period of full-time employment: _____ to _____

Hourly salary: _____

Briefly describe your job duties (add additional page if necessary):

_____ _____
(Signature) (Date)

## Equal Opportunity Statement

The University of Minnesota is committed to the policy that all persons shall have equal access to its programs, facilities, and employment without regard to race, color, creed, religion, national origin, sex, age, marital status, disability, public assistance status, veteran status, or sexual orientation.

Inquiries regarding compliance may be directed to the Director, Office of Equal Opportunity and Affirmative Action, University of Minnesota, or visit www.eoaffact.umn.edu.

This publication is available in alternative formats upon request. Please contact:

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