

## Department of Civil and Environmental Engineering

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Teresa Finis, Director 210 Engineering Hall <a href="https://wiki.engr.illinois.edu/display/ipeng/Home">https://wiki.engr.illinois.edu/display/ipeng/Home</a>	244-0054	<a href="mailto:ipeng@illinois.edu">ipeng@illinois.edu</a>
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# Preface

The Civil Engineering Undergraduate Handbook records all of the requirements associated with earning the degree of Bachelor of Science in Civil Engineering at the University of Illinois at Urbana-Champaign. The degree program is administered by the Department of Civil and Environmental Engineering. This handbook also contains other useful information related to studying civil engineering, being a student in our department, and planning for your future.

The Undergraduate Handbook is revised each year to reflect changes in requirements and other relevant information. The civil engineering curriculum committee works each year to improve the curriculum that we offer to you. Because students generally spend more than one year at the University of Illinois, it is reasonable to ask "which version of the Undergraduate Handbook am I subject to for my graduation requirements?" The handbook that you will use to establish your graduation requirements is either the one published in the year that you started in the program or the one published in the year that you submit your Academic Program Plan. Please be assured that we will always do our best to work out problems that arise because of changes in the Undergraduate Handbook.

If you have any problems, concerns, or suggestions related to the Undergraduate Handbook or, more generally, the undergraduate program in Civil Engineering, please bring them to my attention. Good luck in your studies.

Liang Liu  
Associate Head & Director of Undergraduate Studies  
Department of Civil and Environmental Engineering



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# 1

## Introduction

### 1.1 A civil engineering education

Civil engineering is a profession that applies the basic principles of science in conjunction with mathematical and computational tools to solve problems associated with developing and sustaining civilized life on our planet. Civil engineering is one of the broader of the engineering disciplines both in terms of the range of problems that fall within its purview and in the range of knowledge required to solve those problems. Civil engineering works are generally one-of-a-kind projects; they are often grand in scale; and they usually require cooperation among professionals of many different disciplines. The completion of a civil engineering project involves the solution of technical problems in which uncertainty of information and a myriad of non-technical factors often plays a significant role. Some of the most common examples of civil engineering works include bridges, buildings, dams, airports, highways, tunnels, and water distribution systems. Civil engineers are concerned with flood control, landslides, air and water pollution, and the design of facilities to withstand earthquakes and other natural hazards.

The career paths available to the civil engineer are many and varied and can involve a wide range of activities, tools, situations, clients, and venues—from conceptual design of facilities that do not yet exist to forensic study of facilities that have failed to perform as expected, from advanced simulation of complex systems to the management of people and projects, from private consulting to public service. In addition to the educational objectives that apply to all engineering programs, civil engineers must be as well prepared for a career that traverses this considerable professional breadth as for a career focused on a single professional activity. The civil engineering curriculum is designed specifically to meet this educational challenge by emphasizing fundamental knowledge, transferable skills, and lifelong learning.

The civil engineering program comprises eight main disciplines: (1) construction engineering and management, (2) construction materials engineering, (3) environmental engineering, (4) geotechnical engineering, (5) environmental hydrology and hydraulics, (6) structural engineering, (7) transportation engineering, (8) sustainable and resilient infrastructure systems. While each discipline has its own special body of knowledge and engineering tools, they all rely on the same fundamental core principles. Civil engineering projects often draw expertise from many of these disciplines.

The civil engineering curriculum is designed to develop engineers who have a strong background in mathematics and science, engineers who are articulate, and engineers who understand the nature of their special role in society and the impact of their work on the progress of civilization. The curriculum is designed to guarantee a certain breadth of knowledge of the civil engineering disciplines through a set of core courses and ensure depth and focus in certain disciplines through primary and secondary area of specialization. The curriculum develops the basic engineering tools necessary to solve problems in the field of civil engineering.

## 1.2 Department of Civil and Environmental Engineering-An overview

The Department of Civil Engineering was founded in 1871, having been one of the four branches of the Polytechnic Department since 1867—the year the University of Illinois was founded. In 1998 the name of the department was changed to Civil and Environmental Engineering. Today the department enjoys a strong reputation for undergraduate and graduate education and for civil engineering research and public service. The department is consistently ranked as one of the top civil engineering programs in the country by *U.S. News and World Report* in its annual survey.

The department consists of about 50 faculty, 750 undergraduate students, and 400 graduate students. The department is housed in the Newmark Civil Engineering Laboratory and the Hydrosystems Laboratory on the University of Illinois Urbana-Champaign campus. The department is also the home of the Center of Excellence for Airport Technology (CEAT), the Illinois Center for Transportation (ICT), the Mid-America Earthquake Center (MAE), and other research and educational programs. The department faculty is engaged in numerous research endeavors and many of them hold positions of influence and responsibility in national and international engineering organizations and serve on advisory councils and governmental commissions. Through their research and teaching, the faculty members of the department are educating the next generation of civil engineers to be leaders of a profession that will assure a high quality of life for our civilized world.

Faculty and alumni of our program have contributed to some of the greatest civil engineering achievements in the world. Some examples include the Golden Gate Bridge, the Hoover Dam, the Trans-Alaska pipeline, the Willis (Sears) Tower, the Twin Petronas towers in Kuala Lumpur, and Burj Kalifa, in Dubai. Our graduates are known to be solid citizens of the profession. The Department of Civil and Environmental Engineering boasts one of the largest alumni associations in the world. Illinois civil engineering alumni inhabit many of the key leadership positions in our profession and you are likely to find Illinois graduates on the faculties of many of the civil engineering departments throughout the world. Illinois civil engineering graduates are sought after because they are well educated. When you graduate from the University of Illinois with a degree in civil engineering you go with not only an excellent education, but also the reputation, stature, and recognition that your forebears have worked hard to develop and maintain.

## 1.3 The faculty

The Department of Civil and Environmental Engineering currently has 50 faculty members. Professor Amr S. Elnashai is the Head of the department. Professor Liang Liu and Professor Albert J. Valocchi are Associate Heads of the department in charge of undergraduate and graduate affairs, respectively. The faculty is listed according to specialty below.

Construction Engineering and Management (4)  
N. El-Gohary, K. El-Rayes, L. Liu, (Associate Head), B. Young

Construction Materials Engineering (4)  
D. A. Lange, P. Mondal, J. S. Popovics, L. J. Struble

Environmental Engineering (10)  
T. C. Bond, J. Guest, S. M. Larson (Assistant Dean), W. T. Liu, B. J. Marinas,  
B. S. Minsker, H. Nguyen, M. J. Rood, T. J. Strathmann, C. J. Werth

Environmental Hydrology and Hydraulics (6)  
X. Cai, M. H. Garcia, P. Kumar, G. Parker, M. Sivapalan, A. J. Valocchi (Associate Head)

Geotechnical Engineering (5)

Y. Hashash, G. Mesri, S. M. Olson, C. J. Rutherford, T. D. Stark

Structural Engineering (13)

D. P. Abrams, B. Andrawes, R. H. Dodds Jr., C. A. Duarte, A. S. Elnashai (Head),  
L. A. Fahnestock, D. A. Kuchma, J. M. LaFave, O. Lopez-Pamies, A. Masud, G. H. Paulino, B. F.  
Spencer, Jr., J. Song

Transportation Engineering (8)

I. Al-Qadi, C. P. L. Barkan, R. F. Benekohal, W. G. Buttlar, Y. Ouyang, J. R. Roesler,  
E. Tutumluer, D. B. Work

## 1.4 Important resources

*CEE Department Home Page.* A wide array of information about the Department of Civil and Environmental Engineering is found at the department's website.

<http://cee.illinois.edu/>

*CEE Undergraduate Handbook.* The CEE undergraduate handbook (this document) covers issues specifically related to earning a B.S. in civil engineering. A PDF version is available.

<http://cee.illinois.edu/handbooks>

*CEE Undergraduate Blog.* The CEE undergraduate blog was created as a resource for all undergraduate students. It is updated with information about student organizations, campus or college events, scholarships, advisors, seminars, academic and course information.

<http://uiuccee.typepad.com/undergraduateblog/>

*College of Engineering.* The College of Engineering offers advising for all students, particularly for questions that fall outside the domain of specific departments. The information covers popular topics such as International Programs in Engineering (IPENG), James Scholar, Morrill Engineering Program, Engineering Career Services (ECS) and more.

<http://engineering.illinois.edu>

*Illinois Course Information Suite.* The academic offerings of the university are found together at one website. The Programs of Study, Course Catalog, and Class Schedule are included. You will find here the times, locations, prerequisites, credit, and call numbers of every course offered for a given semester.

<http://courses.illinois.edu>

*Illinois Student Code.* This rule book is published every year. Every issue related to the conduct of business in the university setting is covered in this document. It tells you everything from how to use a bicycle on campus to how to file a grievance to how to get kicked out of school. The text of the Student Code is online at

<http://admin.illinois.edu/policy/code/>

## 1.5 Academic issues

There are certain rules and regulations that may be very important to your life at UIUC. Most of these issues are well documented in the Student Code. Some of the most important ones are briefly described below.

*Course grades.* Grades at the University of Illinois are based on the traditional four point scale (i.e., A+4, B+3, C+2, D+1, F+0). An instructor may elect to distinguish a grade with a plus or a minus. A plus adds 0.333 to the basic grade value and a minus subtracts 0.333 from the basic grade value (e.g., a B+ is worth 3.333 points and a C- is worth 1.667 points). The only exception is the A+ which is worth 4.0 points. The rules associated with the grading system at the University of Illinois are described in the Student Code in Sections 3-101 through 3-104.

If you retake a course—a very good idea for any technical course for which you earn a grade lower than C- (see Section 2.3 for advice on this matter)—the original grade remains on your transcript, as if it were a different course, and continues to be averaged into your GPA.

*Credit/no credit option.* The credit/no credit option is designed to encourage students to explore subjects that they might otherwise avoid for fear of poor grades. The rules concerning the credit/no credit option are described in the Student Code in Section 3-105. To briefly summarize those rules note that (1) all required courses must be taken for a grade, (2) all core and technical courses must be taken for a grade, and (3) most of the humanities and social science electives must be taken for a grade. Free electives and some of the humanities and social science electives can be taken on the credit/no credit option.

Students considering the credit/no credit option are cautioned that many graduate and professional schools consider applicants whose transcripts bear non-graded courses less favorably than those whose transcripts contain none or very few such courses.

*Residency requirements for a Degree.* In addition to specific course and scholastic average requirements, each candidate for a bachelor's degree from the University of Illinois at Urbana-Champaign must earn at least 60 semester hours of University of Illinois at Urbana-Champaign credit, of which at least 21 hours must be 300 or 400 level courses at University of Illinois at Urbana-Champaign campus location. Only those courses that are applicable toward the degree sought may be counted in satisfying the above minimum requirements. A student who requests that the credit requirement for graduation be waived should complete and submit a petition to the dean of his or her college, who will take action on the petition.

*Restrictions on dropping courses.* There is a grace period for adding and dropping courses at the beginning of each semester. Transactions during the first week of classes make it possible for last-minute changes of plans to manifest. You generally have about two weeks after the start of a semester to add a course but it may not result in more than 18 hours of courses without approval from the College of Engineering Office of Undergraduate Programs. There is a longer grace period for dropping a course. You generally have until mid-semester to drop a course; unless it is a required course. All academic deadlines are established by the Office of the Registrar. Their website includes this information.

<http://www.registrar.uiuc.edu/>

If you want to drop a required course (see Section 2.1.1) then you must seek the approval of the Academic Advisor or Associate Head of Civil and Environmental Engineering in charge of undergraduate studies (or a Dean in the Office of Undergraduate Programs). Reasons for dropping a course must be valid. Examples of valid reasons for dropping a course include unanticipated but necessary changes in a work schedule, family emergencies, and illness. You can get approval to drop a course if the event that precipitated your request was beyond your control. Examples of poor reasons are "I am not doing very well in the course" and "I just took the midterm and I think I failed it." The request to drop a course for reasons of this type will almost always be denied. Poor time management and study habits do not build a strong case for dropping a course.

<http://wiki.engr.illinois.edu/display/ugadvise/Adding+or+Dropping+Courses>

**Academic probation and drop rules.** The rules on academic probation and drop are outlined in Section 3-110 of the Student Code. If you have had or are having academic difficulties, then you should read this section of the Code carefully.

The general idea of probation and drop at UIUC is very simple. To earn a degree from UIUC you must have a cumulative GPA of 2.0 or better. If your semester GPA is below 2.0 in any semester, then you are placed on academic probation. While on probation you retain all the rights and privileges of a student at UIUC-it is a warning. If you fail to meet your probation requirements, then you are dismissed from the university. If your semester GPA is below 1.0, then you are dismissed immediately, without probation.

<https://wiki.engr.illinois.edu/pages/viewpage.action?pageId=30803898>

**Academic integrity.** Infractions of academic integrity, such as cheating and plagiarism, are not tolerated at the University of Illinois. The rules that govern academic integrity of all students are covered in Section 1-402 of the Student Code.

[http://admin.illinois.edu/policy/code/article1\\_part4\\_1-402.html](http://admin.illinois.edu/policy/code/article1_part4_1-402.html)

## **1.6 Undergraduate Advising in the Department of Civil and Environmental Engineering**

Undergraduate advising in the Department of Civil and Environmental Engineering is handled by the Associate Head of Civil and Environmental Engineering in charge of undergraduate studies, and the Undergraduate Program Coordinator, and, of course, the faculty. This section gives a brief summary of the responsibilities and expectations of each participant in the advising process.

**The Associate Head.** The Associate Head & Director of Undergraduate Studies is in charge of undergraduate programs and serves as the Chief Advisor and is responsible for setting and administering undergraduate advising policy. The Associate Head is responsible for supervising all personnel involved in undergraduate advising, handles approval of transfer credit for civil engineering courses, and gives final approval of Academic Program Plans, and evaluating all drop and readmission cases. The Associate Head is the point of contact for grievances related to the classroom (course conduct and grading). Appointments are available upon request by calling (217) 333-3812. The Associate Head of Civil and Environmental Engineering in charge of undergraduate programs is

Prof. Liang Liu  
1116 Newmark Civil Engineering Laboratory  
(217) 333-6951  
LLiu1@illinois.edu

**The Academic Advisor.** The Academic Advisor works directly under the Associate Head and is a primary contact with students in the department. The Academic Advisor can answer many questions that students may have and can advise students on navigation of the undergraduate curriculum, campus, college, and department requirements for graduation. The Academic Advisor monitors the academic progress of all students and advises students having academic difficulties, with support of the Associate Head (i.e., those on academic probation). The Academic Advisor works closely with students in establishing study abroad courses, serves as a resource for faculty advisors, resolves questions regarding transfer credit for courses taken at other institutions, and assists the Associate Head with all Academic Program Plans (see Chapter 3). The Academic Advisor schedules advising appointments with the Associate Head, maintains student records, oversees advising holds, manages the department scholarship application process and is the department's main contact person for Student Organizations in Civil and Environmental Engineering. The Academic Advisor is:

Becky Stillwell  
1102 Newmark Civil Engineering Laboratory  
(217) 333-3812  
rborden@illinois.edu

**The administrative staff.** Other administrative staff with responsibilities associated with undergraduate programs includes:

John Kelley, 1241A Newmark Civil Engineering Laboratory, 333-5120, jekelley@illinois.edu  
*Job opportunities, career development fair, internships, the mentor program, and coordination of alumni events of interest to undergraduates.*

Mary Pearson, 1108 Newmark Civil Engineering Laboratory, 333-3811, mkpearso@illinois.edu  
*Undergraduate research program, graduate student records, graduate advising holds.*

Mickey Peyton, 1107 Newmark Civil Engineering Laboratory, 333-6636, mpeyton@illinois.edu  
*Applications for graduate study in civil and environmental engineering at University of Illinois at Urbana-Champaign.*

**The Faculty Advisor.** Each member of the academic faculty has assigned to him or her about fifteen undergraduate advisees. Your faculty advisor will serve as your career mentor in addition to someone who writes a reference letter on your behalf for graduation school application or job search. Your faculty advisor can serve as a resource for learning how to improve your study habits and other life skills that are needed to excel in our program. The faculty advisor is also a good resource for discussing curricular and career decisions. Your faculty advisor cannot make these decisions for you, but he or she can ask you questions and provide information that will help you make the decisions yourself. You should get to know your faculty advisor better and visit him/her on a regular basis. The CEE Department has established a program for faculty advisors to meet their advisees for lunch for free at the Illini Union Ballroom. Do join lunch when your faculty advisor invites you to.

A good working relationship with your faculty advisor can help you succeed in our program. If you feel that there is a personality conflict or that an advisor who is within your field of specialization could be of more benefit to you, do not hesitate to request a change by contacting the Becky Stillwell, CEE Academic Advisor.

You should always feel free to consult other faculty members about any questions you may have. Faculty members enjoy this informal contact with students, but it is up to you to take the initiative to seek them out.

*The College of Engineering Office of Undergraduate Programs.* The Office of Undergraduate Programs is located at 206 Engineering Hall. The Assistant Deans and staff are available for advising and counseling on academic matters. They keep the undergraduate student records in the College of Engineering and they monitor student progress. They are responsible for approving all transfer credit and they deal with most issues that involve the required courses (the "common core" in engineering). They administer all academic issues that involve more than one department (e.g., interdepartmental transfers).

<http://engineering.illinois.edu/current-students>

*Who is my advisor?* You have at least three advisors: (1) your faculty advisor, (2) the Academic Advisor, and (3) the Associate Head or Chief Advisor. In addition, you can seek advice from the Office of Undergraduate Programs, in 206 Engineering Hall, if the matter is department related they will refer you to meet with an advisor in Civil and Environmental Engineering.

*When should I seek advice?* You should seek advice when you need it. However, you should recognize that you will not always know when you need advice. Meeting with your faculty advisor regularly (i.e., at least once per semester) will allow our advising system to help you with those things you don't already know you need advice about. The advising system is here to enhance your chances for success and to alert you to opportunities.

## **1.7 Tutoring and other sources of help**

The engineering curriculum is challenging and resources are available beyond those built into the program (i.e., instructors and teaching assistants). Some student organizations offer free tutoring services for the basic courses. Opportunities are also advertised on the websites of the student organizations.

<http://wiki.engr.illinois.edu/display/ugadvise/Tutoring>

## **1.8 Student organizations and activities**

Civil and environmental engineering student groups provide an excellent opportunity to supplement classroom education through contact with other students, faculty, and practicing engineers. These organizations bring in speakers from various engineering fields, sponsor field trips to construction and manufacturing sites, coordinate Engineering Open House, and attempt to find summer employment for students within civil engineering. The student groups are also the responsible for organization of some of the showcase activities in the department like the Concrete Canoe and the Steel Bridge competitions. All student groups hold regular meetings, most of which are open to nonmembers, so watch for publicity and feel free to attend any meetings. Contact with these organizations can be made through the student group's website or by contacting the Academic Advisor, 1102 Newmark Civil Engineering Laboratory

### ***Student organizations in Civil and Environmental Engineering***

ACI	American Concrete Institute
AREMA	American Railway Engineering and Maintenance-of-Way Association
ASCE	American Society of Civil Engineers
ASEE	American Society for Engineering Education
CCT	Concrete Canoe Team
CMAA	Construction Management Association of America
DFI	Deep Foundations Institute
EERI	Earthquake Engineering Research Institute
EGB	Emerging Green Builders
GESO	Geotechnical Engineering Student Organization
IAHR	International Association for Hydraulic Research
ITE	Institute of Transportation Engineers
IWRA	International Water Resources Association
SEA	Structural Engineers Association

### ***Engineering honor societies***

Chi Epsilon	Civil engineering honor society
Tau Beta Pi	Engineering honor society

### ***College of Engineering student organizations***

EWB	Engineers Without Borders
IAESTE	International Association for the Exchange of Students for Technical Experience
NSBE	National Society of Black Engineers
SHPE	Society of Hispanic Professional Engineers
SETS	Society for Engineering Transfer Students
SWE	Society of Women Engineers
WIE	Women in Engineering

The student organizations generally have web sites that give information about the officers, requirements for joining, the activities, and other information. These websites can all be found at

<http://www.union.uiuc.edu/involvement/rso/>

## **1.9 Cooperative Education, internships and study abroad programs**

There are excellent opportunities available to students to provide practical experience off campus. Among these are the cooperative education program, internships, and the study abroad program. These opportunities are briefly described below.

*Co-op Program.* The College's Engineering Career Services (ECS) offers programs to connect with the leading companies and laboratories and gain up to a full year of professional work experience before graduation. Through these programs, students combine classroom theory with the first-hand experience in the "real world" to learn what engineers do in the professional workplace. Cooperative education positions (co-ops) typically start during the sophomore or junior year. Co-op students alternate at least two semesters and one summer of work with semesters of study, and all work terms are with the same employer. Co-ops typically graduate in five years with a BS degree and one year of professional work experience.

*Internships.* Summer internships are highly recommended. Almost every civil engineering student will have more than one internship experience before graduation. The summers are excellent opportunities to gain two or three months of hands-on experience. The practical experience and opportunity to get to know professional engineers can be key factors in your search for a permanent position after graduation. Academic credit is usually not given for work experiences.

*Study abroad.* Study abroad, or what we have come to call education abroad, is the pursuit of educational opportunities and activities in an international setting. These come in many different shapes and sizes as they vary in academic objectives, length, location, and price. Students who study abroad gain an appreciation of the world. Study abroad can truly be a life-changing experience. Studying abroad prepares students for today's global world in many ways by adding value to their education, allowing them to earn credits abroad, enhancing employability, improving intercultural competence, heightening intercultural communication skills, and giving students access to new information, technologies and skills. Most students find it best to schedule study abroad during their sophomore or junior year. We value the idea of study abroad and will work with students to make it happen.

There are two different programs available (1) Office of International Programs in Engineering (IPENG)- a division of the College of Engineering Undergraduate Affairs Office and (2) the Study Abroad Office (SAO), 124 International Studies Building, part of the International Student and Scholars (ISSS). The college works closely with the campus Study Abroad Office on other study abroad programs in countries around the globe.

The Academic Advisor and Associate Head will work with you to establish a program of study and a tentative agreement for how the credits will transfer back to our program. You must gather all of the relevant information for the institution you will be attending abroad and meet with the Undergraduate Program Coordinator before you leave. Upon your return we will further examine the courses you took to finalize transfer of credits. It is very important to have all of your courses well documented (i.e., with course syllabus and other information).

## **1.10 Career Services**

Career Services are provided by department, college, and university organizations. The CEE department hosts two professional development fairs in September and February. About 70 civil engineering employers visit the Newmark crane bay to recruit students. Read the undergraduate blog for details on the CEE career development fair and other job opportunities throughout the year. The College's Engineering Career Service (ECS) also hosts career fairs, maintains job postings, and arranges on-campus interviews to provide employment opportunities for students. The university also organizes job fairs that span across all the disciplines in the university. For more information about ECS visit the website at

<http://engineering.illinois.edu/current-students/career-services>

## **1.11 James Scholar honors program**

The James Scholar honors program is a College of Engineering program that provides a good student the opportunity to develop a more challenging academic program and to work closely with a member of the faculty on a course of independent study. To be eligible to participate in this program, a student must maintain a cumulative GPA of at least 3.3 through the sophomore year and 3.5 in the junior and senior years. The James Scholar program has two phases, described below.

Phase I (Freshman James Scholar Program) involves freshmen and sophomores. Students who are admitted to the College of Engineering as freshman are eligible to participate in the Freshman James Scholars program provided they achieve an ACT composite score of 33 or higher or an SAT score of 1450 or higher or are in the top 1 percent of their high school graduating class. Freshman James Scholars are allowed to register early and are required to take one honors course per year. Such sections are designated in the class schedule with an "H" at the end of the section designation.

Phase II (Upper-class James Scholar Program) involves juniors and seniors who achieve a minimum cumulative GPA of 3.3. After development and approval at the department level, honors contracts will be submitted to the Associate Dean for Undergraduate Programs at the College of Engineering for final approval. In addition to listing a set of academic activities designed to satisfy the requirements of the Upper-class James Scholar Program, honors contracts will state the overall purpose of the student's proposed honors program and describe the manner in which the planned activities support the purpose. Application for admission is available in 206 Engineering Hall and will be accepted the first two weeks of each semester and during the summer.

The most common question from students is "What constitutes a valid honors contract?" This question is answered at the College of Engineering website for the James Scholar Program.

<https://wiki.engr.illinois.edu/display/engrjames/Home;jsessionid=2008E171C60E52927F302896A70D29E3>

Contact the Academic Advisor for more information on the program or to establish your honors contract.

### **1.12 Graduation honors**

Honors awarded at graduation are designated as Honors, High Honors, and Highest Honors. The designation of Honors is awarded automatically to a student who has a cumulative UIUC grade-point-average (GPA) of at least 3.5 at graduation. The designation of High Honors is automatically awarded to a student with at least a 3.8 GPA. To qualify for Highest Honors, a student must not only meet the GPA requirement for High Honors, but also must have demonstrated outstanding performance in supplementary activities of an academic and/or professional nature. The Associate Head of Civil and Environmental Engineering in charge of undergraduate studies makes recommendations for Highest Honor awards, based upon nominations from the faculty research advisor.

### **1.13 Financial aid and scholarships**

Financial aid for undergraduate students is available from many sources. Coordination of the allocation of these funds is, in general, the responsibility of the Office of Student Financial Aid (Student Services Arcade Building, 620 E. John, 333-0100). Students who wish to be considered for any of the college scholarships must file the usual application for financial aid through the Office of Student Financial Aid. The applicants need not stipulate specific scholarships in their applications. The deadline for submission of applications is usually in mid-March for awards to be made in August of the same year. For more complete information visit the website

<http://www.osfa.uiuc.edu/>

*Civil and Environmental Engineering Department scholarships and awards.* The Department of Civil and Environmental Engineering has many awards and scholarships that are given each year. These scholarships have been established through the generous donations of alumni, private individuals, and industrial sources. One application is used for all awards and scholarships. The application form may be obtained from the Academic Advisor in November. Applications can also be found on the undergraduate web blog. The deadline for submission of applications is at the beginning of the spring semester each year.

*College of Engineering scholarships and awards.* In addition to the sources of financial aid that are available to all university students, undergraduate students in civil engineering may also be eligible for scholarships that are administered by the College of Engineering. Contact the College of Engineering Office of Undergraduate Programs for further information.

### **1.14 Undergraduate research**

One of the things that distinguish the Department of Civil and Environmental Engineering at the University of Illinois from other civil engineering programs is our research. While research has the greatest impact on graduate education, it also provides an opportunity for undergraduates. Any undergraduate student can apply for a grant for up to \$500 to support a research project. The student must find a faculty member willing to advise the project and to certify its completion and merit. Grant applications are available from the Academic Advisor.

Undergraduate research is an excellent way to accomplish several goals. First, it exposes you to the notion of research as one of the many opportunities the university provides and that engineers do as a career outcome. Second, it will give you an experience that will distinguish you from your peers. A small number of undergraduates pursue research because it goes above and beyond their degree requirements. Third, the experience brings a close working relationship with a member of the faculty and with graduate students. Such a relationship can be an extraordinary educational experience and provide you a strong advocate (which you will need to get into graduate school or to land a top job).

### **1.15 Graduate study**

Roughly half of the students who graduate from the civil engineering program here at UIUC go on to pursue graduate study. Most of those earn a master's degree. Some go on for a doctorate. While a B.S. degree in civil engineering provides a solid educational foundation for many career options, many employers place high value on the M.S. degree. In certain disciplines, the M.S. degree is the de facto entry level degree-dictated by the hiring practices of employers. The American Society of Civil Engineers has also issued a statement supporting the M.S. as the entry level professional degree.

There are many factors that will determine whether or not graduate study is right for you—from the grades in your courses to your career aspirations. It is never too early to start thinking about graduate school because every step you take here at the university either enhances or diminishes your prospects.

Graduate programs, admission requirements, and financial aid programs for graduate students vary significantly among universities. Students who are considering graduate study are encouraged to discuss the possibilities with their faculty advisor and with other faculty members. Detailed information in regard to the graduate program of this department may be obtained from the department office.

Graduate study at UIUC. One of the simplest routes to a graduate program is simply to continue your studies at UIUC. There are certainly some advantages to doing so. For example, students who have room for an extra course in their last semester may take courses that may later be applied to their MS degree

requirements. Students who are within 5 semester hours of completing the BS degree requirements may apply for admission to the Graduate College and, if admitted, can complete their BS degree while enrolled as graduate students.

Admission to graduate study in the Department of Civil and Environmental Engineering is based upon your undergraduate GPA, your GRE (Graduate Record Examination) scores, letters of recommendation, and your statement of purpose. The minimum GPA is 3.0/4.0, but some programs may be more competitive than that. Generally, a GPA of 3.5 or above will assure your admission to graduate study. A new "simple entry" program was introduced in Fall 2008 for UIUC CEE students. If you have a GPA of 3.3 or above, you will automatically be admitted to graduate study without further need for the GRE scores, letters of recommendation, or statement of purpose. Students choosing "simple entry" should be interested in the non-thesis track for their MS program. The non-thesis track may facilitate completion of the MS degree within a 12-month period. It is important to realize that some scholarship/fellowship programs and research opportunities may require the GRE scores and letters of recommendation. For many students not interested in research and able to fund their own MS program, the simple entry is an attractive option.

If you do not choose the simplified entry option, you will be required to take the GRE and submit your scores as part of your application to graduate school. Your GRE scores are important in several ways. The GRE allows us to compare your qualifications with applicants from outside of UIUC-where GPA is not as readily compared. Hence, we take the score very seriously. As a general guideline a verbal score of >500, a quantitative score of >650, and a writing score of >4.5 are necessary to gain admission to our graduate program (provided your dossier is free of other weaknesses). A high GRE score will generally get you some notice in competitions for fellowships and assistantships. If you are not happy with your GRE score, you should retake it to ensure that the score reflects your true abilities.

Students in the crease (i.e., between 3.0 and 3.5 GPA and/or just below the GRE cutoffs) are evaluated on a case-by-case basis. The letters of recommendation, details of the undergraduate transcript, and other indicators can play a significant role in deciding admission. Good rapport with UIUC faculty is something you can cultivate as a UIUC undergraduate that students from outside UIUC cannot cultivate. This is a distinct advantage for UIUC graduates.

# 2

## The Curriculum

### 2.1 Overview of the Curriculum

The curriculum leading to the degree of Bachelor of Science in Civil Engineering requires 128 hours and is organized into required courses; math and science electives; civil engineering technical courses; and other electives. A brief summary of the program follows.

#### 2.1.1 Required Courses (67 hours)

The following courses, associated with 67 semester hours of academic credit, are required in the undergraduate curriculum in civil engineering. These courses provide the foundation for the study of civil engineering.

*Orientation and professional development* (1 hour)

ENG 100	Engineering Lecture (freshmen only)	0 hrs
ENG 300	Engineering Transfer Lecture (transfer students only)	0 hrs
CEE 195	About Civil Engineering (all students)	1 hrs
CEE 495	Professional Practice	0 hrs

*Mathematics* (16 hours)

MATH 221	Calculus I	4 hrs
MATH 225	Introductory Matrix Theory ❖	2 hrs
MATH 231	Calculus II	3 hrs
MATH 241	Calculus III	4 hrs
MATH 285	Intro Differential Equations †	3 hrs

❖ MATH 415 Linear Algebra (3 hrs) can be substituted

† MATH 284 Intro Differential Systems (4 hrs) can be substituted

† MATH 286 Intro to Differential Eq Plus (4 hrs) can be substituted

*Basic Sciences* (18 hours)

CHEM 102	General Chemistry I	3 hrs
CHEM 103	General Chemistry Lab I (to be taken with CHEM 102)	1 hrs
CHEM 104	General Chemistry II	3 hrs
CHEM 105	General Chemistry Lab II (to be taken with CHEM 104)	1 hrs
PHYS 211	Univ Physics, Mechanics	4 hrs
PHYS 212	Univ Physics, Elec & Mag	4 hrs
PHYS 213	Univ Physics, Thermal Physics	2 hrs

*Applied Mechanics* (13 hours)

TAM 211	Statics	3 hrs
TAM 212	Introductory Dynamics	3 hrs
TAM 251	Introductory Solid Mechanics	3 hrs
TAM 335	Introductory Fluid Mechanics	4 hrs

*Written Communication* (7 hours)

RHET 105	Principles of Composition	4 hrs
BTW 261	Principles Tech Comm *	3 hrs

\* BTW 250 Principles Bus Comm can be substituted

*Fundamental Engineering Principles and Tools* (12 hours)

GE 101	Engineering Graphics and Design	3 hrs
CS 101	Intro to Computing, Eng & Sci	3 hrs
CEE 201	Systems Engrg & Economics	3 hrs
CEE 202	Engineering Risk & Uncertainty	3 hrs

### **2.1.2 Math and science elective (3 hours)**

Each student must select at least three (3) credit hours of an elective course in math and science. The elective allows the student either to gain additional depth in math or science or to gain breadth in math or science essential to the specialization in one of the branches of civil engineering (e.g., organic chemistry is important to environmental engineering but is not contained within the required science courses). The course should be selected according to the requirements and recommendations for the chosen primary field, as specified in Chapter 5, Advanced Technical Programs. It may be possible to gain approval for a course that is not included on the recommended list for a primary; however, the merit of including the course in your program must be justified on the Academic Program Plan and the course is subject to approval through the program review process. You should obtain approval for such a course from the Associate Head & Director of Undergraduate Studies before you can take the course and put it on your Academic Program Plan.

### **2.1.3 Civil engineering technical program (34 hours)**

The civil engineering technical program is designed to give each student a broad background in the disciplines of civil engineering through the core courses and to allow each student to develop a focused program through advanced technical courses in chosen primary and secondary areas of emphasis. The fundamental principles of civil engineering design and the behavior of civil engineering systems are emphasized throughout the program.

This section describes the civil engineering technical program. Briefly, there are two types of civil engineering courses: (1) core courses and (2) advanced technical courses. The core courses provide the prerequisites to all of the advanced technical courses. The advanced technical courses are subdivided into a primary area of emphasis and a secondary area of emphasis. The core and secondary area courses assure adequate breadth in civil engineering subjects, while the primary area courses allow the student to study a certain subject in great depth. For the student who wishes to gain a broader education in civil engineering, we provide the General Option, which is described in the Section 5.11.

You cannot use an advanced technical course to meet both your primary and secondary requirements. You must have 12 hours from your primary and 6 hours from your secondary. The sum of the semester hours of core courses and technical electives must be at least 34.

### 2.1.3.1 Civil engineering core courses

At least 15 hours of credit (five courses) must be core civil engineering courses. The courses must be selected from the following list:

CEE 300	Behavior of Materials	4 hrs
CEE 310	Transportation Engineering	3 hrs
CEE 320	Construction Engineering	3 hrs
CEE 330	Environmental Engineering	3 hrs
CEE 350	Water Resources Engineering	3 hrs
CEE 360	Structural Engineering	3 hrs
CEE 380	Geotechnical Engineering	3 hrs

Core courses cannot be used as advanced technical courses, but additional core courses can be taken if all of the requirements for advanced technical courses are met.

### 2.1.3.2 Advanced technical electives

The advanced technical electives are selected to satisfy the requirements of a primary area of emphasis (i.e., a major field within civil engineering) and a secondary area of emphasis (i.e., a minor field within civil engineering). The program must have at least 12 hours in the primary field and 6 hours in the secondary field.

*Primary area of emphasis (take at least 12 hours).* The courses in the primary area of emphasis are chosen to be an appropriate program of study within one of the eight disciplines of civil engineering: (1) construction engineering and management, (2) construction materials engineering, (3) environmental engineering, (4) environmental hydrology and hydraulics, (5) geotechnical engineering, (6) structural engineering, (7) transportation engineering, and (8) sustainable and resilient infrastructure systems. Pre-approved programs in each of the areas are listed in Chapter 5, Advanced Technical Programs. Deviations from the pre-approved programs are possible, but subject to the program review process. You must contact the Associate Head & Director of Undergraduate Studies or the Academic Advisor in advance of any deviations from the pre-approved programs.

The value of focusing on one area of study through the primary area courses is twofold. First, it provides a basic education that allows a B.S. graduate to work productively in that field. Second, it provides an education that prepares the student for graduate work in that field.

Guidelines for putting together a primary program in each of the eight main areas of civil and environmental engineering are described in Chapter 5. Note that each program of study has requirements and recommendations on math and science electives and civil engineering core courses. Novel ideas for programs in the primary area can be petitioned through the Academic Program Plan, which is described in Chapter 3. Unusual programs will be subject to review by a standing committee of the faculty (the Program Review Committee) and are subject to approval by the Associate Head of Civil and Environmental Engineering in charge of undergraduate programs.

*Secondary area of emphasis (take at least 6 hours).* The courses in the secondary area of emphasis are chosen to complement the primary area and add breadth to the program of study. Pre-approved secondary programs are listed in Chapter 5, Advanced Technical Programs.

Courses that make up a secondary area can be taken in one of the eight main areas of civil and environmental engineering, but there are also some additional options that give flexibility to the program.

A secondary program cannot be taken in the same area as the primary. The secondary area requirement is meant to provide the student both with additional breadth and with an additional area of special focus. Guidelines for putting together a secondary program in each of the seven main areas of civil and environmental engineering are described in Chapter 5.

A secondary program outside of the eight main civil engineering disciplines is possible, but is subject to the program review process. Some secondary programs that have already been approved are described in Section 5.10. Some ideas on how the secondary area courses can be used include the following (the specific courses for which are still subject to approval):

- (1) The student may wish to pursue study of an engineering field outside of but related to civil and environmental engineering. The secondary area electives could be selected to achieve this goal.
- (2) The student may want to pursue a minor (e.g., there are official minors currently available in both Mathematics and Computer Science). Judiciously selected courses, carefully justified, may allow progress toward the minor while, at the same time, satisfying the secondary area requirement. The math and science electives might also be useful for this purpose. (Of course, free electives can help defray the time it takes to earn a minor).
- (3) The student may have plans to pursue a professional degree in law, business administration, or medicine after completion of a B.S. in civil engineering. Judiciously selected courses, carefully justified, may allow completion of some of the pre-professional courses required for entrance to the professional programs. (Of course, the free electives can be used for these purposes).

The Program Review Committee will look for solid evidence that any proposed program satisfies three basic criteria: (1) the proposed program is not at odds with nor does it dilute the established educational objectives associated with a B.S. degree in civil engineering, (2) the program must be coherent and have clear educational objectives, and (3) the proposed program must clearly be beneficial to the career objectives of the student. The case for a novel program must be made under the *Explanatory Notes and Comments* section of the Academic Program Plan described in Chapter 3. You should obtain preliminary approval for a novel program from the Associate Head for Undergraduate Programs before submitting your Academic Program Plan and before taking any classes in the program.

*The General Option.* The student who wants a broad civil engineering education can elect the General Civil Engineering option (the General Option, for short). The specific course requirements of the General Option are described in Chapter 5. Students who are interested in the General Option are encouraged to discuss with the Associate Head for Undergraduate Programs.

*Curricular requirements associated with engineering design.* The concept of "engineering design" is central to the study of civil engineering. The term "design" means different things to different people, but in the context of civil engineering we mean the process of using fundamental engineering principles in the creation of some facility or process to solve engineering problems or to meet societal demand, such as building a bridge or designing a water treatment plant. The key idea is creation or synthesis. Almost every course in the civil engineering course catalog (see Chapter 6) is a combination of fundamental ideas and their implementation through engineering design. Therefore, each course has some design content associated with it (there are a few exceptions).

Some civil engineering courses have an integrated design project required as part of the course work. The integrated design project provides an engineering design experience based upon knowledge and skills acquired earlier. The design experience incorporates engineering standards and realistic engineering constraints and generally includes economic, social, and political concerns.

The technical program selected by the student must meet the following two criteria for engineering design:

- (1) Each student must take at least one course having an integrated design project. The currently approved courses from which students may select are listed at the end of this chapter in Appendix A, Integrated Design Courses.
- (2) The cumulative engineering design content in the program must be at least 16 hours, where the hours of design content for each course are specified in Appendix B, Design Content of Civil and Environmental Engineering Courses, given at the end of this chapter. Note that only 13 hours of design are required on the Academic Program Plan because the required courses CEE 201 and CEE 202 (which do not appear on the Academic Program Plan) account for 3 hours of design content.

Curricular requirements associated with physical laboratories. Physical laboratory experiences are an essential part of an engineering education. For certain concepts there is no substitute for putting hands on and making observations. There are physical laboratory components to some of the required courses (e.g., the chemistry and physics courses and TAM 335—Introductory Fluid Mechanics). In addition to the laboratories in the required courses, each student is required to complete one core or advanced technical course that has a physical laboratory. This course must be indicated on the Academic Program Plan. Acceptable laboratory courses are listed in Appendix C, Civil Engineering Courses with a Laboratory Component.

#### **2.1.4 Liberal Education Electives (18 hours)**

All programs in the College of Engineering require the completion of at least 18 hours of coursework classified as liberal education electives. The role of these courses in the civil engineering program is to round out the education of the engineer by pursuing ideas different from those contained in the technical courses. These courses are meant to give students the broad education necessary for understanding engineering problems and solutions in a global and societal context.

Liberal education electives must include 6 hours of social & behavioral sciences and 6 hours of humanities & the arts course work from the campus General Education lists. ECON 102 or ECON 103 must be one of the social & behavioral sciences courses. The remaining 6 hours may be selected from a list maintained by the college, or additional course work from the campus General Education lists for social & behavioral sciences or humanities & the arts. Students must also complete the campus cultural studies requirement by completing (i) one western/comparative culture(s) course and (ii) one non-western/U.S. minority culture(s) course from the General Education cultural studies lists. Most students select liberal education courses that simultaneously satisfy these cultural studies requirements. Courses from the western and non-western lists that fall into free electives or other categories may also be used satisfy the cultural studies requirements.

<http://wiki.engr.illinois.edu/display/ugadvise/Liberal+Education+Course+List>

<http://courses.illinois.edu/cis/gened/>

*The Economics requirement.* For civil engineering, either ECON 102 (Microeconomic Principles) or ECON 103 (Macroeconomic Principles) must be included in the 18 hours of humanities and social sciences. The curriculum committee recommends ECON 102 over ECON 103 because the principles of microeconomics are particularly relevant to many of the possible career paths in civil engineering.

*The Advanced composition requirement.* The Advanced Composition GenEd requirement provides an intensive writing course whose goals are (1) to improve understanding of critical issues within a substantive discipline and (2) to improve mastery of technical aspects of writing. This GenEd requirement is satisfied by BTW 261, which is a required course in the civil engineering curriculum. Note that CEE 300 is also approved as an Advanced Comp course. However, taking CEE 300 does not eliminate the need to take BTW 261.

### **2.1.5 Free Electives (6 hours)**

Each student is required to take up to six semester hours of free electives in accordance with the guidelines established by the College of Engineering to reach the total of 128 hours required for a B.S. degree in Civil Engineering. Check the college regulations carefully for restrictions, especially regarding the use of credit for remedial courses, physical education and basic military training. Note that any extra hours you may have taken for other degree requirements carry-over as free elective credit and count toward the 128 hour degree requirement. For example, you may take 4 hours of math, and science electives in which case the extra hour is applied toward free electives.

<http://wiki.engr.illinois.edu/display/ugadvise/Free+Electives>

## **2.2 Prerequisites**

The study of engineering is a process of building on fundamental knowledge. Hence, the prerequisite structure of the courses is extremely important. Prerequisites, as listed in the course catalog, are meant to be a guide to what you are expected to know when you start a certain course. Your success in any course depends strongly upon your mastery of the prerequisite material. For quick reference the prerequisite flow is diagrammed in Fig. 1.

The courses are shown in the earliest possible time slot. Each column of blocks can be thought of as a semester and the courses that appear in a given column can be taken at the same time without violating the prerequisite structure. Time, is measured in semesters, advances from left to right in the diagram. Clearly, any course can be taken later than shown in the figure (e.g., it would probably be a good idea to take PHYS 213 the semester after PHYS 212). The purpose of showing the courses in their earliest possible time slot is that one can easily see any bottlenecks created by prerequisites.

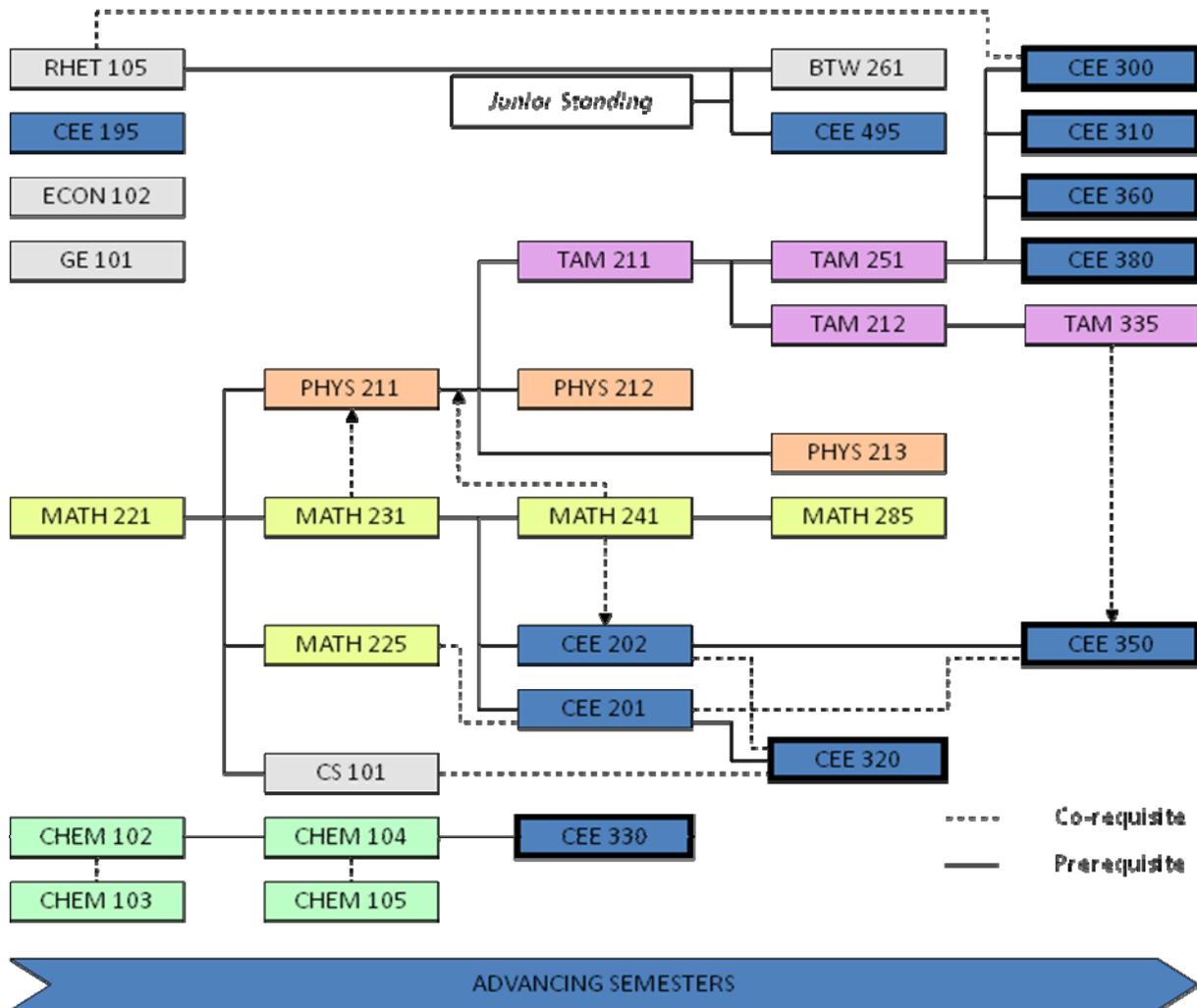


Figure 1. The prerequisite structure of the required and civil engineering core courses

One can observe from this flow chart that many of the civil engineering core courses have four semesters of prerequisites. For example, the course CEE 360 lies at the end of the following prerequisite chain: MATH 221 → PHYS 211 → TAM 211 → TAM 251 → CEE 360.

The prerequisite structure of the courses that are taken after the civil engineering core courses are given for each area in Chapter 5.

## 2.3 Grade Replacement

All undergraduate students on campus can repeat courses and use the new grade to replace the grade they earned in the first attempt. The policy places some limits on the courses and hours that can be replaced. Undergraduates in the College of Engineering can use an online portal to request that a current course be used for grade replacement. For a course to be used for grade replacement, it must have been taken at the University of Illinois at Urbana-Champaign, your first grade must be a C- or lower, and you must not have an officially reported academic integrity violation for the first attempt. Students may repeat for grade replacement up to a total of 4 distinct courses, not to exceed a maximum of 10 semester hours, taken at the University of Illinois at Urbana-Champaign. If you previously requested that a course be used for grade replacement and you have changed your mind, you must visit 206 Engineering Hall in person to rescind your request.

The knowledge that you gain from prerequisite courses will directly determine your chances for success in subsequent courses. If a course is prerequisite to other courses in your program, and you earn a grade below C-, then you should retake that course before moving on with other courses. The grade of D is a passing grade at the University of Illinois and, hence, you earn academic credit for it. However, the grade of D is not adequate preparation for post-requisite courses.

<https://wiki.engr.illinois.edu/display/ugadvise/Grade+Replacement>

## 2.4 Independent study and special topics courses

A student may take an independent study (i.e., CEE 497) or a special topics course (i.e., CEE 498) in partial fulfillment for the degree requirements. Such a course can count as a technical elective in the primary or secondary field and is subject to the program review process. There are many good reasons to include such courses in your curriculum. Some advice on these courses is given below.

*Independent Study (CEE 497).* An independent study is a self-paced study of a particular topic, carried out under the guidance of a certain faculty member. Each faculty member has his or her own section number. An independent study must be taken for a grade if it is to be used toward graduation requirements as a technical elective.

An independent study can be a very rewarding experience for the student who can manage the self-paced nature of the course. The independent study provides an opportunity to include research in your undergraduate program. The graduation honor of "highest distinction" requires the completion of an independent study and the submission of the resulting report or paper.

Each faculty member has a different style in directing independent studies. It is essential to establish, in writing, a clear scope of the work to be done and the expected products (e.g., a written report). Careful planning up front can help you avoid many problems associated with delivering satisfactory results. To help minimize problems associated with execution of an independent study, each student must submit an Independent Study Application/Approval Form. This form includes a description of the independent study and requires the signature of the instructor, the student's advisor, and a department officer (generally the associate head of the department). The form can be obtained from the Academic Advisor.

Because an independent study is self-paced, these obligations tend to find their way to the bottom of even the most organized student's to-do list. As a result, it is common for the student to fail to complete the independent study within the fifteen week context of the semester. It is usually acceptable to continue the

study beyond the confines of the semester, but all parties must be agreeable and a clear plan for completion should be hatched during the semester in which the study was meant to be completed.

*Special topics course (CEE 498).* Special topic courses provide a mechanism to easily introduce new classes into the curriculum. These courses are designated as "experimental courses" because they have not been through the required review process of permanent courses on campus.

Some civil engineering disciplines rely on special topics courses to complete the course offerings in the category of advanced technical courses. These courses will generally be approved by the Program Review Committee for the primary or secondary field in the area which offers the course, even though they do not appear on the list of recommended courses.

## Appendix A. Integrated Design Courses

An integrated design course is a course that has a design project as part of the course requirements. The following courses meet the conditions of an integrated design course.

CEE 401	Concrete Materials
CEE 415	Geometric Design of Roads
CEE 421	Construction Planning
CEE 449	Environmental Engineering Lab
CEE 453	Urban Hydrology and Hydraulics
CEE 465	Design of Structural Systems
CEE 484	Applied Soil Mechanics

## Appendix B. Design Content of Civil and Environmental Engineering Courses

The design content of a course is a number representing the number of credit hours of the course that are directly associated with engineering design. The design content of each CEE course in the catalog are listed below.

CEE 195	Introduction to Civil Engineering	0.00
CEE 201	Systems Engrg & Economics	1.50
CEE 202	Engineering Risk & Uncertainty	1.50
CEE 300	Behavior of Materials	1.00
CEE 310	Transportation Engineering	1.00
CEE 311	Engineering Surveying	1.20
CEE 320	Construction Engineering	1.50
CEE 330	Environmental Engineering	0.50
CEE 350	Water Resources Engineering	1.30
CEE 360	Structural Engineering	0.50
CEE 380	Geotechnical Engineering	1.00
CEE 401	Concrete Materials	1.00
CEE 405	Asphalt Materials, I	2.00
CEE 406	Pavement Design, I	2.50
CEE 407	Airport Design	2.00
CEE 408	Railroad Transportation Engineering	1.00
CEE 409	Railroad Track Engineering	2.00
CEE 410	Railway Signaling and Control	1.00
CEE 411	RR Project Design & Constr	2.00
CEE 415	Geometric Design of Roads	3.00
CEE 416	Traffic Capacity Analysis	1.50
CEE 420	Construction Productivity	2.10
CEE 421	Construction Planning	2.50
CEE 422	Construction Cost Analysis	1.80
CEE 430	Ecological Quality Engineering	1.00
CEE 431	Biomonitoring	2.00
CEE 432	Stream Ecology	1.00
CEE 434	Environmental Systems, I	2.00
CEE 436	Sustainable Urban Bldg Sites	2.00
CEE 437	Water Quality Engineering	1.50
CEE 440	Fate Cleanup Environ Pollutant	1.00
CEE 442	Env Eng Principles, Physical	0.50
CEE 443	Env Eng Principles, Chemical	0.00
CEE 444	Env Eng Principles, Biological	0.00
CEE 445	Air Quality Modeling	0.60

CEE 446	Air Quality Engineering	2.00
CEE 447	Atmospheric Chemistry	0.00
CEE 449	Environmental Engineering Lab	2.00
CEE 450	Surface Hydrology	0.75
CEE 451	Environmental Fluid Mechanics	0.60
CEE 452	Hydraulic Analysis and Design	2.50
CEE 453	Urban Hydrology and Hydraulics	2.70
CEE 457	Groundwater	0.25
CEE 460	Steel Structures, I	2.40
CEE 461	Reinforced Concrete, I	2.40
CEE 462	Steel Structures, II	2.40
CEE 463	Reinforced Concrete, II	2.25
CEE 465	Design of Structural Systems	3.00
CEE 467	Masonry Structures	2.40
CEE 468	Prestressed Concrete	2.40
CEE 469	Wood Structures	2.40
CEE 470	Structural Analysis	1.00
CEE 471	Structural Mechanics	0.30
CEE 472	Structural Dynamics	1.00
CEE 480	Foundation Engineering	2.25
CEE 483	Soil Mechanics and Behavior	1.50
CEE 484	Applied Soil Mechanics	2.50
CEE 490	Computer Methods	1.50
CEE 491	Decision and Risk Analysis	1.50
CEE 495	Professional Practice	0.00
CEE 497	Independent Study*	0.00
CEE 498	Special Topics*	0.00

Note: Design content in CEE 497 and CEE 498 is by default assigned to be zero. The design content in these courses (and courses outside CEE) evaluated on a case-by-case basis. The instructors of the CEE 497 and CEE 498 courses must provide written evidence of design and designated hours for approval by the Program Review Committee. This issue is further discussed in Chapter 3, The Academic Program Plan.

### Appendix C. Civil Engineering Courses with a Laboratory Component

The following courses have a physical laboratory component

CEE 300	Behavior of Materials
CEE 401	Concrete Materials
CEE 405	Asphalt Materials, I
CEE 449	Environmental Engineering Lab
CEE 458	Water Resources Field Methods ( <b>available Summer 2012</b> )
CEE 483	Soil Mechanics and Behavior

### Appendix D. Recently Offered Special Topics Courses (CEE 498)

Special topics courses are offered each semester. Many become permanent courses, some do not.

CEE 498 HSR	High Speed Rail
CEE 498 KUC	Experimental Methods in Structures and Materials
CEE 498 MEA	Multinational Environmental Agreements
CEE 498 PT	Public Transportation



# 3

## Academic Program Plan

### 3.1 What is the Academic Program Plan?

The Academic Program Plan is a contract for the degree of Bachelor of Science in Civil Engineering. The Academic Program Plan must be submitted on the form provided by the department. A copy of this form is contained at the end of this handbook. Note that the form does not cover the required elements of the program, the humanities and social science electives, the general education requirements, or the free electives. These additional requirements must also be satisfied to earn a degree. Hence, an approved program plan is a necessary part of specifying the degree requirements, specific to Civil Engineering. The Degree Audit, described in Section 3.5 below, is helpful in monitoring your progress toward meeting the other degree requirements.

### 3.2 Development and review of the Academic Program Plan

The Academic Program Plan should be developed in consultation with your academic advisor. It is not a valid document without the signature of your academic advisor. Your plan will be reviewed by the CEE advising staff and the Program Review Committee. All Academic Program Plans are subject to final approval by the Associate Head of Civil and Environmental Engineering in charge of undergraduate programs. Notice of approval or disapproval will be sent by email to the student when a decision has been reached. The review process generally takes two to four weeks to complete and, in some cases, involves some revision in the process.

If you include a transfer course on your Academic Program Plan, use the rubric and course number of the course at the institution where you took the course (not what you think might be the equivalent at UIUC). You need to make sure that the intended transfer courses are shown on your academic record by starting a request and review process in room 206 of Engineering Hall.

On the reverse side of the Plan, give the title of the course, the name of the institution where the course was taken, and the semester in which it was taken. If you include a CEE 497 or CEE 498 course on your Academic Program Plan, include a brief description of the independent study or special topic along with the name of the faculty member who supervised the work or offered the course. To expedite approval of your Academic Program Plan, it is advisable to obtain approval of any transfer, CEE 497, or CEE 498 courses before you submit your plan (see Section 3.7).

An accepted Academic Program Plan can be superseded by the submission and acceptance of a new plan. There are many reasons for changing plans, ranging from a change in career plans to realizing that a certain course will not be offered at a certain time. A new plan can be submitted at any time, including the semester in which all degree requirements are finished. Late submissions carry the risk that the new Academic Program Plan will not be accepted and graduation delayed. A new plan will be reviewed on its own merits independent of previous actions. For example, elements of the previously accepted plan (e.g., a certain choice of math and science elective) will be accepted in the new plan only if they continue to have merit.

### **3.3 Submission of the Academic Program Plan**

There are two things you must know about submitting your program plan. You must know when to submit it and where to submit it.

*When.* The Academic Program Plan must be submitted no later than the second week of the spring semester of your 3rd year toward the civil engineering degree. For normal progress, this time corresponds with the second semester of the 3rd year of study. This timing is very important because many of the decisions on elective courses come due at this time. If the Academic Program Plan has not been received by the time indicated above, an advising hold will be placed, preventing registration for future semesters. The advising hold will be lifted upon receipt of the Academic Program Plan.

*Where.* You should submit your Academic Program Plan (and any revisions of it), with your signature and the signature of your faculty advisor, to the Academic Advisor, 1102 Newmark.

### **3.4 Monitoring and assessment of student progress**

The faculty advisor plays an important role in the development of a student's program of study, in monitoring the progress of the student, and in giving general advice on the role of the program in career development. The advising system in the Department of Civil and Environmental Engineering helps to assure that the educational objectives of the program are met to the best of the ability of each student. The department Academic Advisor and the Associate Head of Civil and Environmental Engineering in charge of undergraduate programs provide assistance and information to advisors and provide additional advising support for students.

### **3.5 The degree audit**

The College of Engineering Office of Undergraduate Programs is responsible for approving all degrees. They monitor the progress of each student in the college and report on that progress through a service called DARS or Degree Audit. The degree audit is a computer program that sorts the courses you have taken at UIUC or transferred from another institution against the degree requirements of your program. The degree audit shows your progress in satisfying your degree requirements.

The degree audit is important because it represents the university's view of your progress. If there are errors or discrepancies on your degree audit you should bring them to the attention of the Office of Undergraduate programs immediately. They can work with you to resolve any clerical problems. Students can access their degree audit at

<http://www.registrar.uiuc.edu/dars/index.html>

The degree audit divides your program into basic elements:

REQUIRED COURSES (Section 2.1.1)

TECHNICAL PROGRAM (Section 2.1.3.1)

ADVANCED TECHNICAL ELECTIVES (Section 2.1.3.2)

MATH and SCIENCE ELECTIVES (Section 2.1.2)

LIBERAL EDUCATION ELECTIVES (Section 2.1.4)

The degree audit indicates by a plus (+) those courses you have completed and by a greater than sign (>) those courses in progress. For the courses in the REQUIRED COURSES section a plus is granted if the requirement is met, regardless of how many hours of credit were earned in meeting it. For example, one might transfer a single course that covers our MATH 241 and MATH 225 requirement. Both of those courses then get a plus (with a note underneath about the name of the transfer course and some accounting of the overage and shortage hours). If there is a dash, then the requirement is not met (as far as the degree audit program is concerned).

The second section on the degree audit is titled TECHNICAL PROGRAM. This is the section that will contain the courses from your Academic Program Plan. Before you submit your Academic Program Plan the computer program does not know your intentions. This section will remain blank until an Academic Program Plan is approved. Once approved the specific courses from your Academic Program Plan will be entered into the degree audit and will show as courses to select from. Until your Academic Program Plan is entered into the degree audit systems, courses that you may have taken as part of your TECHNICAL PROGRAM may appear on your audit in the section "CREDIT COUNTING TOWARD TOTAL HOURS, BUT NOT USED IN ANY OTHER REQUIREMENTS."

All changes to your Academic Program Plan must be submitted so that the degree audit can be updated. If you find errors in your degree audit after you have an approved plan you should bring it to the attention of the Academic Affairs office or the Undergraduate Program Coordinator.

### **3.6 Going above and beyond the program requirements**

The graduation requirements outlined in Chapter 2 are minimum requirements. Most people try to hit the minimum right down to the hour, but there is nothing wrong with exceeding the minimum requirements. The most common reason for going above and beyond minimal course requirements is changing majors wherein you discover that certain courses that you have already taken do not count toward your new degree goal. The second most common reason is the desire to take more than the minimum number of technical courses. You may want to learn a few things that we do not require of you (e.g., take an extra core course).

If you plan to take an extra technical elective at the 400 level, that is great. Do it even if your future plans do not necessarily include pursuit of a graduate degree. However, do not list the extra course on your Academic Program Plan as a technical elective. If you list it, then it is part of your B.S. degree. That is the nature of the contract. If you decide to go to graduate school later you will not be able to petition to have the course count as credits toward your M.S. degree, because you already agreed that it would count toward your B.S. degree and your degree was awarded on the basis of that agreement. If, on the other hand, you take the extra course (a good idea) and you do not list it on your Academic Program Plan, then you can petition to use it for graduate credits.

Many CEE 400-level courses have two sections, 3hrs for undergraduates and 4hrs for graduate students. If you intend to use a 400-level CEE course towards your graduate degree in the future, ask permission from the instructor to switch to the 4-hr section.

### **3.7 Independent study and special topics courses**

A student may take an independent study (i.e., CEE 497) or a special topics course (i.e., CEE 498) in partial fulfillment for the degree requirements. Such a course can count only as a technical elective in the primary or secondary field and is subject to the program review process. The section of the program plan called *Explanatory Notes and Comments* should give the title of the course, the instructor's name, and a brief description of the course. The syllabus for the course should be submitted as a supporting document.

The number of hours of design content for CEE 497 and CEE 498 courses is zero unless the instructor specifically requests on a case-by-case basis. The request must include the content of design due to a project or endeavors that demonstrate creativity and problem solving in the context of Civil Engineering. The Program Review Committee will review and approve the request and designated design hours. Some guidance on why you might want to take an independent study course or special topics courses is given in Chapter 2, The Civil Engineering Curriculum.

# 4

## Typical Eight Semester Schedule

There is some flexibility implicit in the sequencing of the courses you must take to complete the curriculum in civil engineering. The order of your courses will be affected by remedial courses, advanced placement, transfer courses, prerequisite courses, and course availability. That said, it is very helpful to see the layout of a typical eight semester program.

<b>First Year</b>	<b>Hours</b>	<b>First Semester (15 or 16 hours)</b>
	1	CEE 195—About Civil Engineering <sup>1</sup>
	3	CHEM 102—General Chemistry I
	1	CHEM 103—General Chemistry Lab I
	0	ENG 100—Engineering Lecture
	4	MATH 221—Calculus I <sup>3</sup>
	3	Liberal Education Elective
	3	GE 101—Engineering Graphics & Design <sup>2</sup> [OR RHET 105—Principles of Composition (4hr)]
	<b>Hours</b>	<b>Second Semester (17 or 16 hours)</b>
	3	CHEM 104—General Chemistry II
	1	CHEM 105—General Chemistry Lab II
	2	MATH 225—Introductory Matrix Theory <sup>4</sup>
	3	MATH 231—Calculus II
	4	PHYS 211—Univ Physics, Mechanics
	4	RHET 105—Principles of Composition <sup>2</sup> [OR GE 101—Engineering Graphics & Design (3hr)]
<b>Second Year</b>	<b>Hours</b>	<b>First Semester (17 hours)</b>
	3	CEE 201—Systems Engrg & Economics
	4	MATH 241—Calculus III
	4	PHYS 212—Univ Physics, Elec & Mag
	3	TAM 211—Statics
	3	Free Elective
	<b>Hours</b>	<b>Second Semester (17 hours)</b>
	3	CEE 202—Engineering Risk & Uncertainty
	2	PHYS 213—Univ Physics, Thermal Physics
	3	TAM 212— Introductory Dynamics
	3	TAM 251— Introductory Solid Mechanics
	3	CS 101—Intro to Computing, Eng & Sci
	3	Liberal Education Elective

<b>Third Year</b>	<b>Hours</b>	<b>First Semester (17 hours)</b>
	3	MATH 285—Intro Differential Equations <sup>5</sup>
	4	TAM 335—Introductory Fluid Mechanics
	7	Civil engineering core courses
	3	Math and science elective <sup>6</sup>
	<b>Hours</b>	<b>Second Semester (15 hours)</b>
	3	BTW 261—Principles Tech Comm <sup>7</sup>
	6	Civil engineering core courses
	3	Advanced technical electives <sup>8</sup>
	3	Liberal Education Elective
<b>Fourth Year</b>	<b>Hours</b>	<b>First Semester (15 hours)</b>
	0	CEE 495—Professional Practice <sup>9</sup>
	3	Civil engineering core courses
	6	Advanced technical electives <sup>8</sup>
	6	Liberal Education Elective
	<b>Hours</b>	<b>Second Semester (16 hours)</b>
	3	Free electives
	3	Liberal Education Elective
	10	Advanced technical electives <sup>8</sup>

### Footnotes

1. CEE 195 is only offered in the fall semester.
2. New freshmen are divided with roughly half enrolled for RHET 105 in the fall and half in the spring of a given year. Those students who are not enrolled for RHET 105 in the fall should take GE 101 during that term and vice versa in the spring.
3. MATH 220— Calculus may be substituted with four of the five credit hours applying toward the degree. Math 220 is appropriate for students with no background in calculus.
4. MATH 415 (3 hours) can be substituted for MATH 225 (2 hours). Two of the three hours of MATH 415 are essentially MATH 225. MATH 415 provides a stronger background in linear algebra and can be used for mathematics minor.
5. MATH 284 or MATH 286 (4 hours) can be substituted for Math 285 (3 hours).
6. Math and Science elective is selected in accord with recommendations for the chosen primary fields of study in civil engineering as outlined in Chapter 5.
7. BTW 261 requires junior standing. This course satisfies the campus Advanced Composition requirement. BTW 250 can be substituted for BTW 261.
8. Advanced technical electives are selected to correspond with chosen primary and secondary fields of study in civil engineering as outlined in Chapter 5.
9. CEE 495 is only offered in the fall semester.

# 5

## Advanced Technical Programs

As part of the requirements for the degree of B.S. in Civil Engineering, each student must complete courses in both a primary and secondary specialization. At least 12 hours must be taken in the primary field and at least 6 hours must be taken in the secondary field. The primary field must be one of the following disciplines of civil engineering: Construction Engineering and Management, Construction Materials Engineering, Environmental Engineering, Environmental Hydrology and Hydraulics, Geotechnical Engineering, Structural Engineering, Transportation Facilities Engineering, Transportation Systems Engineering and Sustainable and Resilient Infrastructure Systems. The secondary fields can be selected from one of the eight disciplines (different from the primary) or a student can select from another group of secondaries listed in this chapter. A student can also elect the General Option in lieu of primary and secondary fields. This section of the handbook gives, for each discipline, a general description of the area and the curricular requirements for a primary or a secondary in that field.

### 5.1 General advice on selecting a primary and secondary field

After the basic decision to major in civil engineering, the next crucial decision is the program requirement of selecting a primary and secondary field of specialization. This decision affects the choice of core courses, the math and science electives, and the advanced technical courses. This choice affects over 30 hours of elective credit and involves up to 3 semesters of prerequisite dependencies. Hence, this decision should be made early in the third year of study. The Academic Program Plan must be submitted no later than after the 75th hour of credit is earned—a time that corresponds closely with this critical decision (see Section 3.3).

There are many things that can be useful in deciding on your specialties—from childhood dreams to recent work experiences. While your experience in the core courses in the various areas may be helpful in making this decision, remember that those courses give only introductory knowledge to fields that harbor lifetimes of interesting experiences that require knowledge far beyond what you can learn in the first course. Your faculty advisor or the Undergraduate Program Coordinator is probably your best resource for sorting out this important career decision.

### 5.2 Organization of the material in this chapter

Each page that follows contains a brief description of the field of study and the course requirements and recommendations for primary and secondary specializations in that field. There is also a flow chart giving the prerequisite structure of all of the courses in that discipline emanating from the required and civil engineering core courses.

### 5.3 Construction Engineering and Management

Construction engineers manage and direct construction operations. Manpower, materials and equipment are analyzed with respect to the job to be done. The proper quantity of each is carefully determined and ordered so that it is available at the appropriate time and place. These civil engineers are knowledgeable in many areas because they deal with the different aspects of civil engineering. They know the capabilities of men, materials, and machinery, and they can translate the details of design specifications into an operation such as drilling deep into the ground for a foundation, or placing the cable over the saddle at the top of a suspension bridge tower. Information management is crucial to construction management. Construction engineers use computers in planning, scheduling, estimating, production forecasting, fiscal control, and inventory tracking.

#### Primary in Construction Engineering and Management

*Math and Science Electives*

Required: None  
Recommended: ATMS 120, ATMS 303, ECE 205, GE 400, FIN 221, GEOL 107, GEOL 116, GEOL 118, GEOL 333, GEOL 380, ME 300, NPRE 201, STAT 420, UP 205

*Civil Engineering Core Courses*

Required: CEE 300, CEE 320, CEE 360, CEE 380  
Recommended: none

*Advanced Technical Courses*

Required: CEE 420, CEE 421, CEE 422, and CEE 461  
Recommended: CEE 401, CEE 460, CEE 469, CEE 480

#### Secondary in Construction Engineering and Management

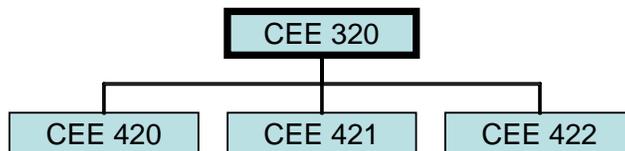
*Civil Engineering Core Courses*

Required: CEE 320

*Advanced Technical Courses*

Required: CEE 421, one of (CEE 420, CEE 422)  
Recommended: none

#### Prerequisite structure for advanced courses in this field



## 5.4 Construction Materials Engineering

Civil engineers are often responsible for specifying, designing, and manufacturing the materials with which they build their structures. Concrete, field welds, and asphalt pavement are examples of materials that are produced or processes that are carried out by the civil engineer in the field. Studies in materials engineering are intended to help civil engineers use materials more intelligently in their design of buildings and other constructed facilities. Topics such as the physics and chemistry of metals, ceramics, and polymers are the bases of this area and lead to the consideration of the response of structural steel, asphalt, and concrete to loads and hostile environments. Engineers with a background in materials engineering often work with consulting companies that specialize in forensic work on failed structures and companies concerned with repair and rehabilitation of the infrastructure.

### Primary in Construction Materials Engineering

#### *Math and Science Electives*

Required: None  
Recommended: GEOL 107, GEOL 333, ME 430, (MSE 401 or ME 300), MSE 402, MSE 420, MSE 450, MSE 486, TAM 427, TAM 428

#### *Civil Engineering Core Courses*

Required: CEE 300, CEE 310  
Recommended: CEE 360, CEE 380

#### *Advanced Technical Courses*

Required: CEE 401, CEE 405  
Recommended: CEE 406, CEE 460, CEE 461, CEE 469, CEE 483, MSE 440, MSE 445

### Secondary in Construction Materials Engineering

#### *Civil Engineering Core Courses*

Required: CEE 300

#### *Advanced Technical Courses*

Required: Two from the recommended list  
Recommended: CEE 401, CEE 405, MSE 440

### Prerequisite structure for advanced courses in this field





## 5.6 Environmental Hydrology and Hydraulic Engineering

Environmental hydrology and hydraulic engineering deals with surface and ground water used for energy, food, transportation, recreation, and hazards mitigation. This field comprises hydrology, hydraulics, and water resources planning. Hydrology concerns how much water comes from the natural environment. Hydraulics concerns how to handle the flow of water. Water resources' planning concerns how to manage water efficiently and economically under hydrologic and hydraulic constraints. Engineers in this discipline are responsible for the planning, design, operation, and management of facilities for domestic, municipal, industrial and agricultural water supply, drainage, control, and utilization. Such facilities include river channel-dam-reservoir systems for flood control, hydropower, navigation, water supply, and recreation; water distribution networks, sewer systems and culverts for urban water supply and drainage; injection/extraction well systems for remediation of contaminated ground water; and erosion and sediment control structures. Hydrosystems engineers are also involved in the planning, operation, and management of ground water, watersheds, and wetlands, as well as the hydrologic environment's response to human impacts and climatic changes.

### Primary in Environmental Hydrology and Hydraulic Engineering

#### *Math and Science Electives*

Required: None  
 Recommended: CS 357, GEOL 107, ME 300

#### *Civil Engineering Core Courses*

Required: CEE 350  
 Recommended: CEE 300, CEE 320, CEE 330, CEE 360, CEE 380

#### *Advanced Technical Courses*

Required: One of (CEE 452, CEE 453)  
 Recommended: CEE 434, CEE 437, CEE 450, CEE 451, CEE 452 or CEE 453, CEE 457

### Secondary in Environmental Hydrology and Hydraulic Engineering

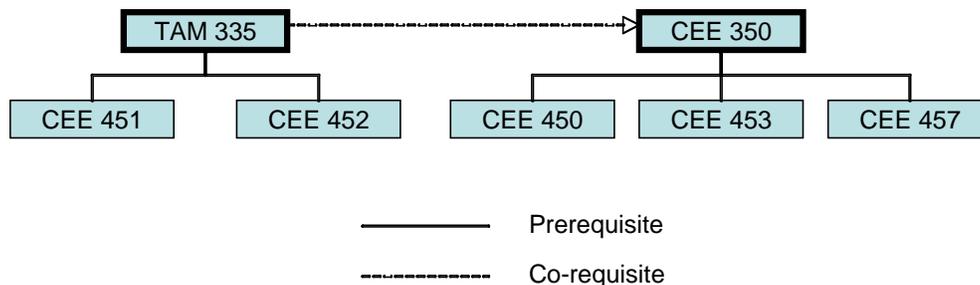
#### *Civil Engineering Core Courses*

Required: CEE 350

#### *Advanced Technical Courses*

Required: Two from the recommended list  
 Recommended: CEE 450, CEE 451, CEE 452, CEE 453, CEE 457

### Prerequisite structure for advanced courses in this field



## 5.7 Geotechnical Engineering

Geotechnical engineers deal with soil and rock as engineering materials. These engineers design foundations for all types of structures, earth and rock-filled dams, tunnels, braced excavations, and earth-retaining structures. They also investigate and design stabilization measures for landslides and other ground failures such as those which occur in earthquakes. Many geotechnical engineers are involved in geo-environmental issues such as solid waste disposal, contaminant transport through soil, and site remediation. A geotechnical engineer should have knowledge of geology and structural engineering.

### Primary in Geotechnical Engineering

#### *Math and Science Electives*

Required: None  
Recommended: GEOL 107, GEOL 118, GEOL, 333, GEOL 380, GEOL 470

#### *Civil Engineering Core Courses*

Required: CEE 360, CEE 380  
Recommended: CEE 310, CEE 320, CEE 330, CEE 350

#### *Advanced Technical Courses*

Required: CEE 483, at least one of (CEE 480, CEE 484)  
Recommended: CEE 457, CEE 460, CEE 461, CEE 462, CEE 463

### Secondary in Geotechnical Engineering

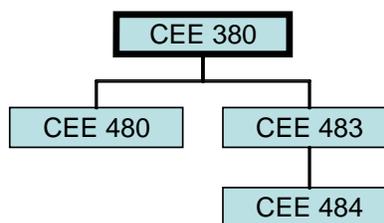
#### *Civil Engineering Core Courses*

Required: CEE 380

#### *Advanced Technical Courses*

Required: CEE 480  
Recommended: CEE 483, CEE 484

### Prerequisite structure for advanced courses in this field



## 5.8 Structural Engineering

Structural engineering involves the analysis, design, and construction of buildings, dams, bridges, and other types of facilities. A structural engineer designs economical structures that satisfy requirements of safety, utility, and durability; oversees the building of constructed facilities; and investigates the performance of structures that fail to perform as expected. The tools of the structural engineer include physical testing, mathematical modeling, and computer simulation. The structural engineer uses these tools to make decisions that aid in the creation, maintenance, or demolition of constructed facilities. The largest of structures, such as the Golden Gate Bridge, Hoover Dam, and Eiffel Tower, stand as monuments to the engineering achievements of humankind. The smallest of structures, such as thin films that contain computer circuitry, make possible many devices in our technologically sophisticated society.

### Primary in Structural Engineering

#### *Math and Science Electives*

Required: None  
 Recommended: CS 357, GEOL 107, ECE 205, ECE 290, ME 300

#### *Civil Engineering Core Courses*

Required: CEE 300, CEE 360, CEE 380  
 Recommended: None

#### *Advanced Technical Courses*

Required: CEE 460, CEE 461, CEE 465, CEE 470  
 Recommended: None

### Secondary in Structural Engineering

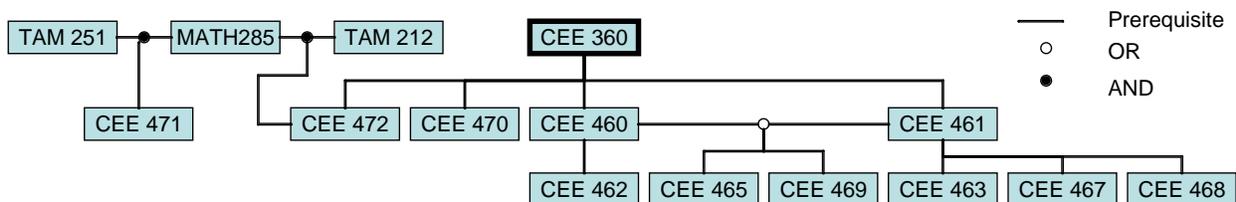
#### *Civil Engineering Core Courses*

Required: CEE 360

#### *Advanced Technical Courses*

Required: CEE 460, CEE 461  
 Recommended: None

### Prerequisite structure for advanced courses in this field



## 5.9 Transportation Engineering

Transportation engineers design, build, operate and maintain all types of facilities for railroads, automobiles, airplanes, and ships. They deal with the physical infrastructure of our transportation system—highways, ports, airports, and other facilities. They are involved in controlling traffic and in developing better transportation systems. Transportation engineers must understand the many factors that affect the long-term performance of the infrastructure from climatic factors imposed on it to the dynamics of the vehicles that use it. Transportation engineers are concerned with the development and operation of our multi-modal transportation system to meet the constantly changing social, economic, geographical, and political needs of society.

### Primary in Transportation Engineering

#### *Math and Science Electives*

Required: None  
Recommended: CS 357, (ECE 205 or ECE 290) GEOL 107, (GE 320 or ME 340), MATH 442, ME 300, MSE 401, STAT 420

#### *Civil Engineering Core Courses*

Required: CEE 300, CEE 310  
Recommended: CEE 320, CEE 330, CEE 350, CEE 360, CEE 380  
Parkland's CIT 255 "Engineering Surveying" may also serve as a core course.

#### *Advanced Technical Courses*

Required: You must select one course from the each of the three Areas and one from the recommended list. A deviation from this plan should receive approval from a transportation faculty.

\*Area 1 — Facilities: CEE 405, CEE 406  
\*Area 2 — Systems: CEE 415, CEE 416  
\*Area 3 — Railroad: CEE 408, CEE 409, CEE 410  
Recommended: CEE 401, CEE 405, CEE 406, CEE 407, CEE 408, CEE 409, CEE 410, CEE 415, CEE 416, CEE 480, CEE 498 RD, CEE 498 RH

### Secondary in Transportation Engineering

#### *Civil Engineering Core Courses*

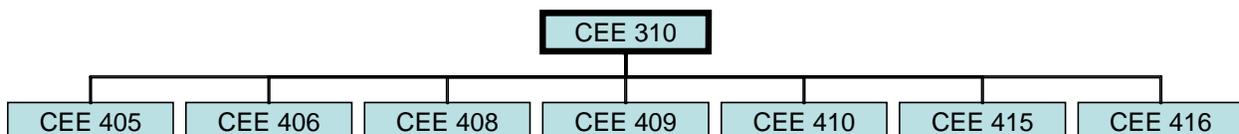
Required: CEE 310

#### *Advanced Technical Courses*

Required: You must select two courses, each from a different Area\*

\*Area 1 — Facilities: CEE 405, CEE 406  
\*Area 2 — Systems: CEE 415, CEE 416  
\*Area 3 — Railroad: CEE 408, CEE 409, CEE 410  
Recommended: None

### Prerequisite structure for advanced courses in this field



## 5.10 Sustainable and Resilient Infrastructure Systems

This primary is for students interested in holistically planning, designing, and managing CEE sustainable and resilient infrastructure systems and their interactions. This discipline provides integrated, multidisciplinary and systems-based education within civil and environmental engineering. The capability for synthesis across areas of CEE is particularly suited for careers in general CEE design firms, government agencies, and higher education. Students interested in sustainability within one particular area of CEE are encouraged to combine a primary in that area with sustainability as a secondary.

### Primary in Sustainable and Resilient Infrastructure Systems

#### *Math and Science Electives*

Recommended UP 406, ENSU 300, ESES 140, ESES 320, ESES 482, NRES 439, STAT 420, NPRES 201, ATMS 120, FIN 221, CS 357, GE 320

#### *Civil Engineering Core Courses*

Recommended: CEE 330 or CEE 350, CEE 300, CEE 310, CEE 380, CEE 398 Engineering for the Global Environment (starting Fall 2012)

#### *Advanced Technical Courses*

Required: CEE 491 Decision and Risk Analysis  
CEE 498 Sustainable and Resilient Infrastructure Systems (starting Spring 2012)

Recommended: CEE 401, CEE 406, CEE 408, CEE 409, CEE 416, CEE 417, CEE 421, CEE 434, CEE 436, CEE 458, CEE 453, CEE 465, CEE 497, ABE 436, ARCH 480, MSE, 489

## 5.11 Additional Civil Engineering Secondaries

### Secondary Area in Sustainability

The CEE Secondary in Sustainability is designed for students who want to integrate sustainability into one of the existing primaries, providing technical depth in a core CEE area with an understanding of how sustainability issues affect CEE practice and research. Some examples (not inclusive) of CEE-related sustainability topics are given below, along with corresponding primaries that students may want to select with the sustainability secondary:

- Construction material recycling and reuse – Construction Management
- Green construction materials – Construction Materials Engineering
- Water reuse and energy reclamation from waste – Environmental Engineering
- Waste power generation in landfills - Geotechnical Engineering
- Storm water capture and best management practices – Hydrology
- Green building design – Structural Engineering
- Permeable pavements and green transportation system design – Transportation

#### *Math and Science Electives*

Recommended: ATMS 120, ENSU 300, ESES 140, ESES 320, ESES 482, NRES 439, NPRE 201, UP 406

#### *Civil Engineering Core Courses*

Recommended: CEE 330 or 350, 300, 310, 380  
CEE 398 Engineering for the Global Environment (starting Fall 2012)

#### *Advanced Technical Courses*

Required: None

## Secondary Area in CEE Multidisciplinary

The frontiers of CEE are becoming increasingly multidisciplinary, spanning sub-fields of CEE as well as other engineering and non-engineering fields. The purpose of this secondary is to provide guidelines for students with interests that do not align with an existing secondary option to develop custom multidisciplinary programs. All custom programs must be approved by the student's advisor, the CEE Program Review Committee, and the Associate Head for Undergraduate Programs during the student's junior year in CEE.

### *Math and Science Electives*

Recommended: Any recommended Math & Science elective from the existing CEE primaries and secondaries

### *Civil Engineering Core Courses*

Recommended: Core courses relevant to the student's interests

### *Advanced Technical Courses*

These courses represent the technical heart of the CEE undergraduate program and provide the majority of required design hours. Students should consider the following guidelines in selecting advanced technical courses for a custom secondary:

- Courses selected should provide background technical knowledge and skills needed to address CEE-related problems and processes. Students may propose any engineering and non-engineering courses (minimum of 6 hours) at the 300- or 400-levels as long as the total design hours of a student's program plan meets the ABET requirement of 16 hours. Students should provide a brief justification for the selection of their courses in the "Explanatory Notes and Comments" section of the academic program plan.
- Students may fulfill a portion of this requirement through an independent design project (CEE 497) supervised by a CEE faculty member.
- Design hours can be assigned for CEE 497 projects or engineering courses outside of CEE, but cannot be assigned for non-engineering courses. The Associate Head for Undergraduate Program will determine assignment of design hours in consultation with the course instructor.

## Secondary Area in Global Context

Students interested in the global context of CEE are encouraged to pursue the International Minor in Engineering (<http://www.engr.illinois.edu/international>) and to select General Education requirements, humanities and social science electives, and free electives that address global culture, international regulations, history, geography, economics, politics, sociology, language, or literature. The courses that are particularly recommended to provide context on global issues relevant to CEE include GEOG 384, GLBL 480, NPRES 483, UP 185, UP 423, UP 424, ESES 481, and GE 462.

### *Math and Science Electives*

Recommended: ESES 140, ESES 320, ESES 482, CPSC 116

### *Civil Engineering Core Courses*

Recommended: CEE 330 or 350, CEE 398 Engineering for the Global Environment (starting Fall 2012)

### *Advanced Technical Courses*

Required: Students must take at least: (1) 3 credit hours that provide knowledge and skills needed to effectively address global issues and (2) 3 credit hours that enable them to design holistically by coupling expertise in their specialty with an understanding of system-level interactions and sustainability issues that affect their designs.

### *Knowledge and Skills Needed to Effectively Address Global Issues (3 hrs)*

Recommended: CEE 445, CEE 447, CEE 450, CEE 498, MEA, ACE 451, ATMS 421, ECON 420

### *Global CEE Design (3 hrs)*

Recommended: CEE 407, CEE 408, CEE 417, CEE 436, CEE 437, CEE 449, CEE 465, CEE 497

## 5.12 Other Secondary Areas

It is possible to select a secondary field of study that does not align directly with one of the main disciplines of civil engineering. In general, these secondary fields should have an appreciable connection to at least one of the civil engineering disciplines or to a career outcome that would benefit from an education in civil engineering. Novel programs are subject to review by the Program Review Committee and must be approved by the Associate Head of Civil and Environmental Engineering in charge of undergraduate studies.

The curriculum committee has, in the past, approved the following secondary areas. These secondary fields are exemplary of the possible breadth allowable within our program and can be used as a springboard for developing others. Note that for secondary fields outside CEE one must carefully examine the prerequisites for the courses listed. Recommendations for Mathematics and Science electives are given for these secondary areas. In some cases, these electives might address the prerequisites for certain Advanced Technical Courses.

### **Atmospheric Science**

Primary field: Environmental Engineering

#### *Civil Engineering Core Courses*

Required: CEE 330

#### *Advanced Technical Courses*

Recommended: ATMS 302, ATMS 402, ATMS 410, ATMS 411, ATMS 421, CEE 445, CEE 447

### **Chemistry**

Primary field: Environmental Engineering

#### *Civil Engineering Core Courses*

Required: CEE 330

#### *Advanced Technical Courses*

Recommended: CHEM 232, CHEM 315, CHEM 332, CHEM 420, CHEM 440

### **Chemical Engineering**

Primary field: Environmental Engineering

#### *Civil Engineering Core Courses*

Required: CEE 330, CEE 350

#### *Advanced Technical Courses*

Recommended: CHBE 321, CHBE 421\*, CHBE 422, CHBE 424, CHBE 451

### **Microbiology**

Primary field: Environmental Engineering

#### *Civil Engineering Core Courses*

Required: CEE 330

#### *Advanced Technical Courses*

Recommended: MCB 301, MCB 450\*, (MCB 431 or CEE 444)

**Risk and Reliability**

Primary field: Any

*Civil Engineering Core Courses*

Required: None

*Advanced Technical Courses*

Recommended: CEE 491, IE 435

**Toxicology**

Primary field: Environmental Engineering

*Civil Engineering Core Courses*

Required: CEE 330

*Advanced Technical Courses*

Recommended: CHEM 332, ENVS 431, ENVS 432, ENVS 451, ENVS 480, MCB 450

## 5.13 The General Civil Engineering Option

The General Option was created to recognize that there are career opportunities in Civil and Environmental Engineering for which great breadth of understanding of all aspects of Civil Engineering has merit over specialization. Some civil and environmental engineers solve problems which require the interaction with other engineering and non-engineering disciplines. These problems can, and often do, involve multiple teams with diverse expertise and background. Students choosing the General Civil Engineering option are encouraged to discuss with their faculty advisor and/or CEE advising staff.

### The requirements of the General Option

#### *Math and Science Electives*

Required: Two from recommended list  
Recommended: GEOL 107, CHEM 222, CHEM 232, ME 300, STAT 400

#### *Civil Engineering Core Courses*

Required: CEE 300, CEE 310, CEE 320, CEE 330, CEE 350, CEE 360, CEE 380

#### *Advanced Technical Courses*

Required: Option I: Pick no more than one course from each area to satisfy the requirement that the sum of the core and advanced courses be at least 34 hours.  
Option II: Pick two courses from one area and no more than one course from each of the remaining areas until you reach 34 hours.

#### Acceptable advanced technical courses:

Construction	CEE 420, CEE 421, CEE 422
Environmental	CEE 437, CEE 440, CEE 446
Geotechnical	CEE 480, CEE 483
Hydrosystems	CEE 452, CEE 453
Materials	CEE 401
Structures	CEE 460, CEE 461
Transportation	CEE 405, CEE 406, CEE 408, CEE 409, CEE 410, CEE 415, CEE 416

#### Notes:

- (1) The General Option requires seven civil engineering core courses, as opposed to the five in the ordinary program. Hence, all of the basic civil engineering disciplines are covered at the core level.
- (2) All of the acceptable advanced technical courses are 3 hour courses, except for CEE 401, CEE 415, CEE 453 and CEE 483 which are 4 hour courses. Hence, in most cases this option requires 5 advanced technical courses.
- (3) The acceptable advanced technical courses are listed in numerical order within each area. There is no implication that the first course listed is more appropriate than the second, third, or fourth.



# 6

## Civil Engineering Courses

### Catalog Descriptions

This section of the handbook contains the course descriptions for 100, 200, 300, and 400 level courses taught through the Civil and Environmental Engineering department. The courses are listed in numerical order. The rubric CEE is implied. Each entry has a brief description, the prerequisites, and the number of hours of credit for the course. These entries should correspond exactly to the Course Catalog.

- 195. About Civil Engineering.** Civil engineering orientation course including historical developments, education requirements, relation to science, professional practice, and specialties within the profession. 1 hours.
- 199. Undergraduate Open Seminar.** Topics will vary each semester. Please see section topic. Approved for both letter and S/U grading. May be repeated .
- 201. Systems Engrg & Economics.** Introduction to the formulation and solution of civil engineering problems. Major topics are: engineering economy, mathematical modeling, and optimization. Techniques, including classical optimization, linear and nonlinear programming, network theory, critical path methods, simulation, decision theory, and dynamic programming are applied to a variety of civil engineering problems. Prerequisite: MATH 231; credit or concurrent registration in MATH 225. 3 hours.
- 202. Engineering Risk & Uncertainty.** Identification and modeling of non-deterministic problems in civil engineering design and decision making. Development of stochastic concepts and simulation models and their relevance to real design and decision problems in various areas of civil engineering. Prerequisite: MATH 231; credit or concurrent registration in MATH 241. 3 hours.
- 300. Behavior of Materials.** Same as TAM 324. Mechanical behavior of engineering materials, including metals, ceramics polymers, concrete, wood, bitumens, and asphaltic concretes; explanations of macroscopic behavior in terms of phenomena at the microscopic level. Lecture/lab format. Prerequisite: Completion of Composition I general education requirement; TAM 251. 4 hours.
- 310. Transportation Engineering.** An introduction to the design, planning, operation, management, and maintenance of transportation systems; integrated multi-modal transportation systems (highways, air, rail, etc.); layout of highways, airports, and railroads with traffic flow models, capacity analysis, and safety. Design of facilities and systems with life cycle costing procedures and criteria for optimization. Prerequisite: TAM 251; credit or concurrent registration in CEE 202. 3 hours.
- 311. Engineering Surveying.** Introduction to surveying and photogrammetry. Prerequisite: CEE 202; credit or concurrent registration in CS 101. 4 hours.

- 320. Construction Engineering.** Introduction to the construction processes: contracting and bonding, planning and scheduling, estimating and project control, productivity models, and construction econometrics. Prerequisite: CEE 201; credit or concurrent registration in CS 101 and CEE 202. 3 hours.
- 330. Environmental Engineering.** Considers the sources, characteristics, transport, and effects of air and water contaminants; biological, chemical, and physical processes in water; atmospheric structure and composition; unit operations for air and water quality control; solid waste management; and environmental quality standards. Prerequisite: CHEM 104. 3 hours.
- 350. Water Resources Engineering.** Quantitative aspects of water in the earth's environment and its engineering implications, including design and analysis of systems directly concerned with use and control of water; quantitative introduction to hydrology, hydraulic engineering, and water resources planning. Prerequisite: CEE 202; credit or concurrent registration in TAM 335 and CEE 201. 3 hours.
- 360. Structural Engineering.** Basic topics in the analysis, behavior and design of trusses and framed structures under static loads; topics include member forces in trusses, shear and moment diagrams, deflections, simple applications of the force method and slope-deflection; introduction to computer applications. Prerequisite: TAM 251. 3 hours.
- 380. Geotechnical Engineering.** Introduction to geotechnical engineering. Classification of soils, compaction in the laboratory and in the field, soil exploration, boring and sampling, permeability of soils, one-dimensional settlement analyses, strength of soil, introduction to foundations. Prerequisite: TAM 251. 3 hours.
- 401. Concrete Materials.** Examines the influence of constituent materials (cements, aggregates and admixtures) on the properties of fresh and hardened concrete; mix design handling and placement of concrete; and behavior of concrete under various types of loading and environment; test methods. Laboratory practice is an integral part of the course. Prerequisite: CEE 300. 4 hours.
- 405. Asphalt Materials, I.** Properties and control testing of bituminous materials, aggregates for bituminous mixtures, and analysis and design of asphalt concrete and liquid asphalt cold mixtures; structural properties of bituminous mixes; surface treatment design; and recycling of mixtures. Prerequisite: CEE 310. 3 hours.
- 406. Pavement Design, I.** Analysis, behavior, performance, and structural design of pavements for highways and airfields; topics include climate factors, rehabilitation, life cycle design economics, and traffic loadings. Prerequisite: CEE 310. 3 hours.
- 407. Airport Design.** Basic principles of airport facilities design to include aircraft operational characteristics, noise, site selection, land use compatibility, operational area, ground access and egress, terminals, ground service areas, airport capacity, and special types of airports. 3 hours.
- 408. Railroad Transportation Engineering.** Principles and analysis of railroad transportation efficiency, economics, energy, and engineering; effect on production and markets. Introduction to railroad infrastructure; locomotive and rolling stock design, function, and operation. Calculation of train speed, power, and acceleration requirements; introduction to railway traffic control and signaling. Quantitative analytical tools for railroad transportation decision-making and optimization. Field trip to observe railroad infrastructure, equipment and operations. Prerequisite: CEE 310. 3 hours
- 409. Railroad Track Engineering.** In depth examination of railroad track engineering concepts including track component and system design, constructions, evaluation, maintenance, load distribution, and wheel/rail interaction. Design and analysis tools for railroad track engineering and maintenance. Field trip to observe railroad track system and components. Prerequisite: CEE 310. 3 hours.

- 410. Railway Signaling and Control.** Railway traffic and control and signaling systems; train performance and scheduling tools; analysis of temporal and spatial separation of trains for safety and efficiency; train movement authority and operating rules; track circuit and wireless train position monitoring technology; interlocking design; railroad capacity modeling tools and economic analysis of traffic control system design, optimization and selection. Field trip to observe signal system infrastructure and railway traffic operations control center. Prerequisite: CEE 310. 3 hours.
- 411. RR Project Design & Constr.** Critical elements in the development and planning of railroad construction projects; project economic justification; route alternative analysis procedures; cost estimation; site civil design; computer-aided track design; surveying; construction management; construction procedures for typical railroad projects. Design project covering a typical railroad capital construction projects. Field trip to observe the construction of a railroad capital project. Prerequisite: CEE 310. 3 hours.
- 415. Geometric Design of Roads.** Analysis of factors in developing a highway transportation facility; traffic estimates and assignment; problems of highway geometrics and design standards; planning and location principles; intersection design factors; street systems and terminal facilities; programming improvements; drainage design; structural design of surface; concepts of highway management and finance; and highway maintenance planning. Prerequisite: CEE 310. 4 hours.
- 416. Traffic Capacity Analysis.** Study of fundamentals of traffic engineering; analysis of traffic stream characteristics; capacity of urban and rural highways; design and analysis of traffic signals and intersections; traffic control; traffic impact studies; and traffic accidents. Prerequisite: CEE 310. 3 hours.
- 417. Urban Transportation Planning.** Same as UP 430. Role of transportation in urban development and planning; characteristics of urban-person transportation systems and methods of analysis and forecasting of urban-person transportation demand; transportation systems management and capital improvement programming; and emphasis on the needs and activities of metropolitan planning organizations. 4 hours.
- 420. Construction Productivity.** Introduction of the application of scientific principles to the measurement and forecasting of productivity in construction engineering. Conceptual and mathematical formulation of labor, equipment, and material factors affecting productivity. Prerequisite: CEE 320. 3 hours.
- 421. Construction Planning.** Project definition; scheduling and control models; material, labor and equipment allocation; optimal schedules; project organization; documentation and reporting systems; and management and control. Prerequisite: CEE 320. 3 hours.
- 422. Construction Cost Analysis.** Introduction to the application of scientific principles to costs and estimates of costs in construction engineering; concepts and statistical measurements of the factors involved in direct costs, general overhead costs, cost markups and profits; and the fundamentals of cost recording for construction cost accounts and cost controls. Prerequisite: CEE 320. 3 hours.
- 430. Ecological Quality Engineering.** Examines the characteristics of rivers and lakes which affect the management of domestic and industrial wastewaters; includes assessment of chemical hazards, and introduction to surveillance and biomonitoring, and a review of regulations governing effluents. Prerequisite: CEE 330. 2 hours.
- 431. Biomonitoring.** Discusses the theory and application of biomonitoring as a component of environmental management; reviews a range of techniques to analyze effluents and assess condition and trend in the environment, using biological and ecological systems; and emphasizes biomonitoring program design, selection and analysis of data, and interpretation of biomonitoring results. Prerequisite: CEE 430. 3 hours.
- 432. Stream Ecology.** Description of physical, chemical, and biological characteristics in streams and rivers including an integrated study of the environmental factors affecting the composition and distribution of biota; emphasizes the application of ecological principles in aquatic ecosystem protection and management. Same as IB 450. Prerequisite: CEE 430. 3 hours.

- 434. Environmental Systems, I.** Introduction to the concepts and applications of environmental systems analysis. Application of mathematical programming and modeling to the design, planning and management of engineered environmental systems, regional environmental systems, and environmental policy. Economic analysis, including benefit-cost analysis and management strategies. Concepts of tradeoff, non-inferior sets, single and multi-objective optimization. Practical application to case studies to convey an understanding of the complexity and data collection challenges of actual design practice. Prerequisite: CEE 201 or GE 330; CEE 330.3 hours.
- 436. Sustainable Urban Bldg Sites.** Identification of sustainability indicators, identification and design of sustainable technologies associated with water and energy management for urban buildings, and sites, and acceptance evaluation of sustainable technologies from technical, economic, and social perspectives using life cycle analysis. Sustainable technology applications to water reuse, storm water management, alternative energy, energy conservation, and new building approaches and materials, Design teams work together on homework assignments and final design project proposing a sustainable redevelopment strategy for an urban building and the surrounding site. Prerequisite: CHEM 104 and MATH 231. 4 hours.
- 437. Water Quality Engineering.** Fundamental theory underlying the unit processes utilized in the treatment of water for domestic and industrial usage, and in the treatment of domestic and industrial wastewaters. Prerequisite: CEE 330; credit or concurrent registration in TAM 335. 3 hours.
- 440. Fate Cleanup Environ Pollutant.** Investigation of the regulatory and technical issues affecting solid and hazardous waste management, with an emphasis on the principles governing the transport, fate, and remediation of solid and hazardous waste in the subsurface, including advection, dispersion, sorption, interphase mass transfer, and transformation reactions. Prerequisite: CEE 330. 4 hours.
- 442. Env Eng Principles, Physical.** Analysis of the physical principles which form the basis of many water and air quality-control operations; sedimentation, filtration, inertial separations, flocculation, mixing and principles of reactor design. Prerequisite: CEE 437. 3 hours.
- 443. Env Eng Principles, Chemical.** Application of principles of chemical equilibrium and chemical kinetics to air and water quality. Chemistry topics are thermodynamics, kinetics, acid/base chemistry, complexation, precipitation, dissolution, and oxidation/reduction. Many applications are also presented. Prerequisite: CEE 437. 4 hours.
- 444. Env Eng Principles, Biological.** Application of principles of biochemistry and microbiology to air and water quality, wastes, and their engineering management; biological mediated changes in water and in domestic and industrial wastewater. Prerequisite: CEE 443. 3 hours.
- 445. Air Quality Modeling.** Overview of practical and advanced approaches to air pollution modeling, including aspects of pollutant transport, transformation, and loss. Models considered include: Gaussian plume, chemical mass balance, chemical reaction, grid and trajectory. Evaluation of models and the development of efficient control strategies are also discussed. Same as ATMS 425. Prerequisite: CEE 330 and credit or concurrent registration in TAM 335; or ATMS 401. 3 hours.
- 446. Air Quality Engineering.** Description and application of chemical and physical principles related to air pollutants, aerosol mechanics, attenuation of light in the atmosphere, air quality regulation, generation of air pollutants, methods to remove gaseous and particulate pollutants from gas streams, and atmospheric dispersion. Prerequisite: CEE 330; credit or concurrent registration in TAM 335. 3 hours.
- 447. Atmospheric Chemistry.** Course will present current knowledge of the biochemical cycles of atmospheric trace gases, their interactions on global and regional scales, and their significance for the chemistry in the atmosphere. The important fundamental concepts that are central to understanding air pollutants, e.g., the formation of aerosols and the transformation and removal of species in the atmosphere, will be introduced. Same as ATMS 420 and ENVS 450. Prerequisite: CHEM 104; either CEE 330 or ATMS 401. 3 hours.

- 449. Environmental Engineering Lab.** Combination of lecture and laboratory designed to provide exposure to the use of traditional analysis tools and techniques in analysis, control, and design of natural and engineered environmental systems including air, water, wastewater, solid and hazardous waste, and ecological systems. Prerequisite: CEE 437 or CEE 446. 3 hours.
- 450. Surface Hydrology.** Study of descriptive and quantitative hydrology dealing with the distribution, circulation, and storage of water on the earth's surface; discusses principles of hydrologic processes and presents methods of analysis and their applications to engineering and environmental problems. Prerequisite: CEE 350. 3 hours.
- 451. Environmental Fluid Mechanics.** Incompressible fluid mechanics with particular emphasis on topics in analysis and applications in civil engineering areas; primary topics include principles of continuity, momentum and energy, kinematics of flow and stream functions, potential flow, laminar motion, turbulence, and boundary-layer theory. Prerequisite: TAM 335. 3 hours.
- 452. Hydraulic Analysis and Design.** Hydraulic analysis and design of engineering systems: closed conduits and pipe networks; hydraulic structures, including spillways, stilling basins, and embankment seepage; selection and installation of hydraulic machinery. Prerequisite: TAM 335. 3 hours.
- 453. Urban Hydrology and Hydraulics.** Hydraulic analysis and design of urban, highway, airport, and small rural watershed drainage problems; discussion of overland and drainage channel flows; hydraulics of storm-drain systems and culverts; determination of design flow; runoff for highways, airports, and urban areas; design of drainage gutters, channels, sewer networks, and culverts. Prerequisite: CEE 350. 4 hours.
- 457. Groundwater.** Physical properties of groundwater and aquifers, principles and fundamental equations of porous media flow and mass transport, well hydraulics and pumping test analysis, role of groundwater in the hydrologic cycle, groundwater quality and contamination. Prerequisite: CEE 350 and TAM 335, or consent of instructor. 3 hours.
- 458. Water Resources Field Methods.** Scientific principles of measurement technologies and protocols used for water-resources measurements and experimental design of field-scale water-resources and environmental studies. Planning field studies; instruments and protocols for surface-water, ground-water, and water-quality sampling; description of data quality. One-half-day laboratory field trips to streamflow monitoring stations and groundwater monitoring wells nearby. Prerequisite: CEE 350. 4 hours (**available summer 2012**)
- 460. Steel Structures, I.** Introduction to the design of metal structures; behavior of members and their connections; and theoretical, experimental, and practical bases for proportioning members and their connections. Prerequisite: CEE 360. 3 hours.
- 461. Reinforced Concrete, I.** Study of the strength, behavior, and design of reinforced concrete members subjected to moments, shear, and axial forces; extensive discussion of the influence of the material properties on behavior. Prerequisite: CEE 360. 3 hours.
- 462. Steel Structures, II.** Metal members under combined loads; connections, welded and bolted; moment-resistant connections; plate girders, conventional behavior, and tension field action. Prerequisite: CEE 460. 3 hours.
- 463. Reinforced Concrete, II.** Study of the strength, behavior, and design of indeterminate reinforced concrete structures, with primary emphasis on slab systems; emphasis on the strength of slabs and on the available methods of design of slabs spanning in two directions, with or without supporting beams. Prerequisite: CEE 461. 3 hours.

- 465. Design of Structural Systems.** The whole structural design process including definition of functional requirements, selection of structural scheme, formulation of design criteria, preliminary and computer-aided proportioning, and analysis of response, cost, and value. Prerequisite: Credit in either CEE 460 or CEE 461 and concurrent enrollment in the other. 3 hours.
- 467. Masonry Structures.** Introduction to analysis, design and construction of masonry structures. Mechanical properties of clay and concrete masonry units, mortar, and grout. Compressive, tensile, flexural, and shear behavior of masonry structural components. Strength and behavior of unreinforced bearing walls. Detailed design of reinforced masonry beams, columns, structural walls with and without openings, and complete lateral-force resisting building systems. Prerequisite: CEE 461. 3 hours.
- 468. Prestressed Concrete.** Study of strength, behavior, and design of prestressed reinforced concrete members and structures, with primary emphasis on pretensioned, precast construction; emphasis on the necessary coordination between design and construction techniques in prestressing. Prerequisite: CEE 461. 3 hours.
- 469. Wood Structures.** Mechanical properties of wood, stress grades and working stresses; effects of strength-reducing characteristics, moisture content, and duration of loading and causes of wood deterioration; glued-laminated timber and plywood; behavior and design of connections, beams, and beam-columns; design of buildings and bridges; other structural applications: trusses, rigid frames, arches, and pole-type buildings; and prismatic plates and hyperbolic paraboloids. Prerequisite: CEE 460 or CEE 461. 3 hours.
- 470. Structural Analysis.** Direct stiffness method of structural analysis; fundamentals and algorithms; numerical analysis of plane trusses, grids and frames; virtual work and energy principles; introduction to the finite element method for plane stress and plane strain. Prerequisite: CEE 360. 4 hours.
- 471. Structural Mechanics.** Beams under lateral load and thrust; beams on elastic foundations; virtual work and energy principles; principles of solid mechanics, stress and strain in three dimensions; static stability theory; torsion; computational methods. Prerequisite: MATH 385 and TAM 251. 3 hours.
- 472. Structural Dynamics, I.** Analysis of the dynamic response of structures and structural components to transient loads and foundation excitation; single-degree-of-freedom and multi-degree-of-freedom systems; response spectrum concepts; simple inelastic structural systems; and introduction to systems with distributed mass and flexibility. Prerequisite: TAM 212, MATH 385, and CEE 360. 3 hours.
- 480. Foundation Engineering.** Analysis and design of foundations, bearing capacity and settlement of foundations; stability of excavations and slopes; ground movements due to construction; analysis and design of excavations, retaining walls, slopes and underground structures in soil and rock. Prerequisite: CEE 380. 3 hours.
- 483. Soil Mechanics and Behavior.** Composition and structure of soil; water flow and hydraulic properties; stress in soil; compressibility behavior and properties of soils; consolidation and settlement analysis; shear strength of soils; compaction and unsaturated soils; experimental measurements. Prerequisite: CEE 380. 4 hours.
- 484. Applied Soil Mechanics.** Application of soil mechanics to earth pressures and retaining walls, stability of slopes, foundations for structures, excavations; construction considerations; instrumentation. Prerequisite: CEE 483. 4 hours.
- 490. Computer Methods.** Review of programming concepts; formulation and programming of numerical, data processing, and logical problems with applications from various branches of civil engineering; organization of programs and data; and development and use of problem-oriented programming languages in civil engineering Same as CSE 491. Prerequisite: CS 101. 3 hours.

- 491. Decision and Risk Analysis.** Development of modern statistical decision theory and risk analysis, and application of these concepts in civil engineering design and decision making; Bayesian statistical decision theory, decision tree, utility concepts, and multi-objective decision problems; modeling and analysis of uncertainties, practical risk evaluation, and formulation of risk-based design criteria, risk benefit trade-offs, and optimal decisions. Prerequisite: CEE 202. 3 hours.
- 495. Professional Practice.** Series of lectures by outstanding authorities on the practice of civil engineering and its relations to economics, sociology, and other fields of human endeavor. 0 undergraduate hours. Prerequisite: Junior standing. 0 hours.
- 497. Independent Study.** Individual investigations or studies of any phase of civil engineering selected by the student and approved by the department. Prerequisite: Senior or graduate standing; Consent of instructor. 1 to 16 undergraduate hours.
- 498. Special Topics.** Structured presentations of new and developing areas of knowledge in civil engineering offered by the faculty to augment the formal courses available. Prerequisite: Individually identified for each offering under this course number. 1 to 4 hours.

## 6.1 Semester Course Offerings

CEE courses are usually offered in the semesters shown in the table below. This information is for planning purposes, and is subject to change. Students should always depend on the university class schedule for reliable information when registering for upcoming semesters.

CEE Course	TITLE	FALL	SPRING	FA & SP	Varies
195	About Civil Engineering	X			
199	Undergraduate Open Seminar	X			
201	Systems Engrg & Economics			X	
202	Engineering Risk & Uncertainty			X	
300	Behavior of Materials			X	
310	Transportation Engineering			X	
311	Engineering Surveying				X
320	Construction Engineering			X	
330	Environmental Engineering			X	
350	Water Resources Engineering			X	
360	Structural Engineering			X	
380	Geotechnical Engineering			X	
401	Concrete Materials	X			
405	Asphalt Materials, I	X			
406	Pavement Design, I	X			
407	Airport Design		X		
408	Railroad Transportation Engineering	X			
409	Railroad Track Engineering	X			
410	Railroad Signaling and Control		X		
411	RR Project Design & Constr		X		
415	Geometric Design of Roads		X		
416	Traffic Capacity Analysis	X			
417	Urban Transportation Planning		X		
420	Construction Productivity		X		
421	Construction Planning			X	
422	Construction Cost Analysis	X			
430	Ecological Quality Engineering				X
431	Biomonitoring				X
432	Stream Ecology				X
434	Environmental Systems, I	X			
436	Sustainable Urban Bldg Sites	X			
437	Water Quality Engineering	X			
440	Fate Cleanup Environ Pollutant		X		
442	Env Eng Principles, Physical	X			
443	Env Eng Principles, Chemical	X			

<b>CEE Course</b>	<b>TITLE</b>	<b>FALL</b>	<b>SPRING</b>	<b>FA &amp; SP</b>	<b>Varies</b>
444	Env Eng Principles, Biological		X		
445	Air Quality Modeling		X		
446	Air Quality Engineering	X			
447	Atmospheric Chemistry		X		
449	Environmental Engineering Lab		X		
450	Surface Hydrology	X			
451	Environmental Fluid Mechanics	X			
452	Hydraulic Analysis and Design		X		
453	Urban Hydrology and Hydraulics		X		
457	Groundwater	X			
458	Water Resources Field Methods				X
460	Steel Structures, I			X	
461	Reinforced Concrete, I			X	
462	Steel Structures, II	X			
463	Reinforced Concrete, II		X		
465	Design of Structural Systems			X	
467	Masonry Structures				X
468	Prestressed Concrete	X			
469	Wood Structures				X
470	Structural Analysis			X	
471	Structural Mechanics	X			
472	Structural Dynamics, I	X			
480	Foundation Engineering		X		
483	Soil Mechanics and Behavior			X	
484	Applied Soil Mechanics		X		
490	Computer Methods				X
491	Decision and Risk Analysis		X		
495	Professional Practice	X			
497	Independent Study			X	
498	Special Topics			X	



# Department of Civil and Environmental Engineering

# Sample - Academic Program Plan

**The Academic Program Plan** is a contract for the degree of *Bachelor of Science in Civil Engineering* at the University of Illinois at Urbana-Champaign. This plan covers the technical elective portion of your degree requirements. You must also complete all required courses, general education requirements, humanities and social science electives, and free electives. Courses that appear on this plan must be selected according to the program requirements specified in the *Civil Engineering Undergraduate Handbook*. To elect the General Option indicate General Option as the primary field and leave secondary field blank. A revised program can be proposed at any time by submitting a new Academic Program Plan for approval. **The Academic Program Plan must be completed in ink.**

### Mathematics and Science Electives (3 hour Minimum)

Select according to requirements and recommendations of the chosen primary and secondary fields.

### Civil Engineering Technical Courses

(Core Courses + Advanced Courses = 34 hours minimum)

#### Core Courses

Select from CEE 300, CEE 310, CEE 320, CEE 330, CEE 350, CEE 360, and CEE 380.

**Notes:** Traditional program with primary and secondary fields requires five core courses (at least 15 hours). The General Option requires seven core courses. Primary and secondary fields and the General Option have specific course requirements and recommendations. See program Guidelines in the *Undergraduate Handbook*.

#### Advanced Courses

Program must include at least 12 hours from the primary field and 6 hours from the secondary field. For requirements of the General Option see *Undergraduate Handbook*. Design content of program must exceed 13 hours for all courses listed on this plan (note that 3 hours of design credit are associated with CEE 201 and CEE 202 to give total of 16 hours). At least one integrated design course must be included in the program.

### Explanatory Notes and Comments

A section for explanatory notes and comments is provided on the reverse side. Note any transfer courses by course number, title, and institution.

### Required Signatures

\_\_\_\_\_  
Student Date

\_\_\_\_\_  
Faculty Advisor Date

\_\_\_\_\_  
Program Review Committee Date

\_\_\_\_\_  
Associate Head of Civil and Environmental Engineering Date

John Q. Student  
\_\_\_\_\_  
Student's Name (Please type or print.) Net ID

J. M. Advisor  
\_\_\_\_\_  
Faculty Advisor's Name (Please type or print.)

6509452312 May 2014  
\_\_\_\_\_  
UIN Degree Date

Primary Field Structures

Secondary Field Geotechnical

Course	Credit Hrs	Design Hrs
GEOL 107	4	0
Subtotals	4	0

CEE 300	4	1
CEE 320	3	1.5
CEE 350	3	1.3
CEE 360	3	0.50
CEE 380	3	1
Subtotals	16	5.3

CEE 460	3	2.4
CEE 461	3	2.4
CEE 465	3	3
CEE 470	3	1
CEE 480	3	2.25
CEE 483	4	1.5
Subtotals	19	12.55

### Summary Program Requirements

Please enter information in all boxes.

Total CEE technical credit  
(Core + Advanced Courses) 35

Total Design credit  
(Sum of all design hours above,  
plus 3 hours from 201 & 202) 20.85

Integrated design course  
(Give course number.) CEE 465

Laboratory course  
(Give course number.) CEE 300

***Explanatory Notes and Comments (to be filled out by student)***

This section should be used to justify a program that is not pre-approved in the *Undergraduate Handbook*.

For a CEE 497 or CEE 498 course included in the program give instructor, title, date and a brief description of the topics covered.

***Advisor Comments (to be filled out by the faculty advisor)***

This section should provide supporting remarks either for a program that is not pre-approved in the *Undergraduate Handbook* or for a request to deviate from standard program requirements (e.g., design content requirements).

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