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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 associated with 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 information that is contained in it. Certainly, one of the things that can change are program requirements. 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 else 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.

David A. Lange
Professor and Associate Head
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 broadest 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 play 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 performed 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, the civil engineer must be as well prepared for a career that traverses this considerable professional breadth as for a career focussed 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 seven 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, and (7) transportation engineering. 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, 600 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 other 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 Sears tower, and the twin Petronas towers in Kuala Lumpur. 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 54 faculty. Professor Robert H. Dodds, Jr., is the Head of the department. Professor David A. Lange and Professor Albert J. Valocchi are Associate Heads of the department in charge of undergraduate and graduate affairs, respectively. The faculty are listed according to specialty below.

**Construction Engineering and Management (5)**
C. Arboleda (Visiting), F. Boukamp, K. El-Rayes, L. Liu, F. Peña-Mora,

**Construction Materials Engineering (3)**
D. A. Lange (Associate Head), J. S. Popovics, L. J. Struble

**Environmental Engineering (12)**
T. C. Bond, K. T. Finneran, E. E. Herricks, S. M. Larson (Assistant Dean), W. Liu,
B. J. Marinas, B. S. Minsker, E. Morgenroth, 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)**
1.4 Important documents and websites

There are a few very important documents written to help you navigate through your program here at the University of Illinois. The Civil Engineering Undergraduate Handbook (this document) is one of several important handbooks. It covers issues specifically related to earning a B.S. in civil engineering. To find more information about the Department of Civil and Environmental Engineering visit the department’s website.

http://cee.uiuc.edu/

Civil Engineering Student Web Blog. The web 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. Here is the website.

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

Some other documents and websites that you might find helpful, and are often referenced herein, are given below.

*Programs of Study.* Published every two years, this document gives information that is relevant to all programs at the university. It describes admission requirements, costs, the general education requirements, financial aid, and many other things.

*Course Catalog.* Published every two years, this document gives brief descriptions, prerequisites, and hours of credit for every course offered at this university. This document is available online.

*Class Schedule.* Published every semester and available for pre-registration, this document lists the times, locations, prerequisites, credit, and call numbers of every course offered for the semester indicated. The front of the Timetable also has important information about registration, the calendar (e.g., add and drop deadlines). The Programs of Study, Course Catalog, and Class Schedule are available online at

http://courses.uiuc.edu/cis/index.html

*Undergraduate Programs of Study in Engineering.* Published every two years, this document gives a brief overview of all of the programs available in the College of Engineering. It may be useful in comparing different programs within the college and in understanding the general requirements of the first two years of study. It also contains information on minors offered by the College of Engineering. To find out more information about the College of Engineering, visit the website.

http://www. engr.uiuc.edu/students/prospective/programs.php
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://www.admin.uiuc.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 all (1) 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 (see College of Engineering rules in Undergraduate Programs of Study in Engineering).

Students considering the credit/no credit option are cautioned that many graduate and professional schools consider applicants whose transcripts bear nongraded courses less favorably than those whose transcripts contain no 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 Office of Academic Affairs. 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 Admissions and Records. Their website includes this information.

http://www.oar.uiuc.edu
If you want to drop a required course (see Section 2.1.1) then you must seek the approval of the Associate Head of Civil and Environmental Engineering in charge of undergraduate programs (or a Dean in the Academic Affairs office). There are good reasons and not-so-good reasons for dropping a course. Examples of poor reasons are “I am not doing very well in the course” and “I just took the midterm and I think I flunked it.” The request to drop a course for reasons of this type will almost always be rejected. Poor time management and poor study habits do not build a strong case for dropping a course. Examples of valid reasons for dropping a course include unanticipated but necessary changes in a work schedule, family emergencies, and illness. Of course, these problems must be documented in some way.

The key concept is this: You can get approval to drop a course if the events that precipitated your request were beyond your control.

Academic probation and drop rules. Although we hope that your classroom performances will always be good ones, the reality is that some students get into academic trouble. If you get into too much trouble then you will be dismissed from the university. 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 this section of the Code carefully. Your future at this university may depend upon it.

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.

Academic integrity. Infractions of academic integrity 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://www.admin.uiuc.edu/policy/code/article_1/a1_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 programs, the department Undergraduate Advisor, certain members of the administrative staff, 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 of Civil and Environmental Engineering in charge of undergraduate programs serves as the Chief Advisor and is responsible for setting and administering undergraduate advising policy in the Department of Civil and Environmental Engineering. The Associate Head is responsible for assigning faculty advisors and supervising all personnel involved in undergraduate advising. The Associate Head handles approval of transfer credit for civil engineering courses and gives final approval of Academic Program Plans. The Associate Head handles all drop and readmission cases. The Associate Head is the point of contact for grievances related to the classroom (course conduct and grading). The Associate Head is the author of the Civil Engineering Undergraduate Handbook. The Associate Head serves all of the functions of the Undergraduate Advisor if the Undergraduate Advisor is not available. The Associate Head is available to all students at all times. The Associate Head of Civil and Environmental Engineering in charge of undergraduate programs is
The Undergraduate Advisor. The Undergraduate advisor works directly under the Associate Head and is primarily responsible for advising that requires knowledge of campus, college, and department requirements for graduation. The Undergraduate Advisor monitors the academic progress of all students and advises students in academic trouble (i.e., those on academic probation). The Undergraduate Advisor works with coop and study abroad students in establishing their programs. The Undergraduate Advisor serves as a resource for faculty advisors. The Undergraduate Advisor resolves questions regarding transfer credit for courses taken at other institutions. Finally, the Undergraduate Advisor reviews all Academic Program Plans (see Chapter 3) and works with students, faculty, and the Program Review committee to resolve problems with Academic Program Plans. Like the Chief Advisor, the Undergraduate Advisor is available to all students. The Undergraduate Advisor is:

Prof. Liang Liu
3129d Newmark Civil Engineering Laboratory
(217) 333-6951
lliu1@illinois.edu

The Undergraduate Program Coordinator. The Undergraduate Program Coordinator works directly under the Associate Head and is a primary contact with students in the Department. The Coordinator can answer many questions that students may have and, with the support of the Associate Head, can advise students on navigation of the undergraduate curriculum. Students should contact the Coordinator first, and if further advising is required, the Coordinator can schedule appointments with the with the Undergraduate Advisor or Associate Head. The Coordinator maintains student records, distributes and collects Academic Program Plans, oversees advising holds, and manages the Department scholarship application process. The Coordinator is the Department’s main contact person for Student Organizations in the Department. The Undergraduate Program Coordinator is:

Becky Borden
1114 Newmark Civil Engineering Laboratory
(217) 333-3812
rborden@illinois.edu

The administrative staff. Other administrative staff with responsibilities associated with undergraduate programs include:

John Kelley, 1102 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 ten undergraduate advisees. The responsibility of the faculty advisor is to answer questions about campus, college, or department academic requirements (or, often, to refer those questions to the Undergraduate Advisor or Associate Head). 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.

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 Undergraduate Program Coordinator.

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 Academic Affairs Office. The College of Engineering Office of the Associate Dean for Undergraduate programs (we shall refer to it as the Academic Affairs office throughout this document) is located at 206 Engineering Hall. The Assistant Deans and the staff in the Academic Affairs office 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).

The website maintained by the Academic Affairs office has extensive information on advising issues.

http://www.engr.uiuc.edu/students/current/advising.php

Who is my advisor? You have at least four advisors: (1) your faculty advisor, (2) the Undergraduate Program Coordinator, (3) the Undergraduate Advisor, (4) the Associate Head or Chief Advisor. You must determine which person you should see for each issue. Your faculty advisor is a good place to start with any issue. You can find out who is your faculty advisor online at the Academic Programs website listed above.

When should I seek advice? Conventional wisdom would suggest that 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 out with even 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). Particularly for the required courses (math, chemistry, and physics). Some student organizations offer free tutoring services for the basic courses. Opportunities are also advertised on the websites of the student organizations. The website listed below is maintained by the Academic Programs Office and contains information on tutoring.

http://www.engr.uiuc.edu/Advising/engrtutor.php
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 of these groups hold regular meetings, most of which are open to nonmembers, so watch for publicity and feel free to attend any or all such public meetings. Contact with these organizations can be made through the department office, 1114 Newmark Civil Engineering Laboratory.

Student chapters of national organizations

- ACI American Concrete Institute
- ASCE American Society of Civil Engineers
- EERI Earthquake Engineering Research Institute
- ITE Institute of Transportation Engineers
- SEA Structural Engineers Association

Engineering honor societies

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

Other local organizations

- SHPE Society of Hispanic Professional Engineers
- SWE Society of Women Engineers

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/a-z_list.aspx

1.9 Cooperative Education, internships and study aboard programs.

There are certain opportunities available to students that take you off campus. Among these are the cooperative education program, internships, and the study abroad program. These opportunities are briefly described below.

**Experiential Learning Programs.** Engineering Career Services offers three types of Experiential Learning Programs to help students connect with the leading companies and laboratories and gain up to a full year of professional work experience before graduation. Through these Experiential Learning 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.

Semester interns work four to seven months (a semester may be combined with a summer) with one company and then resume their coursework. Students may complete more than one internship
with the same company or different one company if desired. Semester interns generally delay their
graduation one semester and gain valuable work experience.

Summer interns gain two or three months of hands-on experience during the summer break. Summer internships are recommended for all students. **An internship is not an academic program. Therefore, no academic credit is given for work experiences.**

Career fairs, job postings, and on-campus interviews provide employment opportunities for students interested in participating in Experiential Learning Programs. When accepted for employment during a semester, students register with Engineering Career Services to maintain student status during the employment period. For more information visit Engineering Career Services, 3270 Digital Computer Lab, or visit the website at

http://www.engr.uiuc.edu/ecs/students/programs.php

**Study abroad.** The student who has the “wander lust” can participate in the Study Abroad program. Students who study abroad gain an appreciation of the world in which we live that cannot be gained any other way. Study abroad can truly be a life-changing experience. It may come at a sacrifice, as most civil engineering programs abroad are not organized the same way as ours is and it is often a challenge to make the two transitions without overlaps and gaps in your education. Most students find it best to schedule study aboard during sophomore or junior year. We value the concept of study abroad and will work hard to make it work as well as possible for you.

There are two different programs available (1) Office of International Programs in Engineering (IPENG)—a division of the College of Engineering Academic Affairs office and (2) the Study Abroad Office, 115 International Studies Building, part of the International Programs and Studies (IPS). The college works closely with the campus Study Abroad office on other study abroad programs in countries around the globe.

The department Undergraduate Advisor will work with you to establish a program of study and a tentative agreement for how the credit 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 Advisor before you depart. Upon your return we will further examine the courses you took to finalize transfer of credit. It is very important to have all of your courses well documented (i.e., with course syllabus and other information).

**1.10 The 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. The honors program is highly recommended for students planning on going to graduate school. 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 (Upperclass James Scholar Program) involves juniors and seniors who achieve a minimum cumulative GPA of 3.30. After development and approval at the department level, honors contracts will be submitted to the Associate Dean for Academic Affairs at the College of Engineering for final approval. In addition to listing a set of academic activities designed to satisfy the requirements of the Upperclass 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 are 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.

http://jamesscholar.cen.uiuc.edu/

Contact the Undergraduate Program Coordinator for more information on the program or to establish your honors contract. The Undergraduate Program Coordinator with support of the Honors Advisor can answer any questions. The Undergraduate Program Coordinator is Becky Borden, rborden@illinois.edu, 1114 NCEL and the Honors Advisor is Prof. David A. Lange, dlange@illinois.edu, 1116 NCEL.

1.11 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 3.50 at graduation. The designation of High Honors is automatically awarded to a student with at least a 3.80 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 programs makes recommendations for Highest Honor awards, based upon nominations from the faculty research advisor.

1.12 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 and department 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 a number of 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 unified application is used for all awards and scholarships. The application form may be obtained from Becky Borden in 1114 Newmark Civil Engineering Laboratory. The deadline for submission of applications is at the end of the fall semester each year. A listing of scholarships and an application form can be found on the student web blog.

http://uiuccee.typepad.com/undergraduateblog/
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 Academic Affairs office for further information.

1.13 Undergraduate research

One of the things that distinguishes 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 Becky Borden in 1114 NCEL.

Undergraduate research is an excellent way to accomplish several goals. First, it will expose you to the notion of research as one of the other things that goes on at the university and one of the other things that engineers do as a career outcome. Second, it will give you an experience that will distinguish you from your peers. Not very many undergraduates pursue research because it goes above and beyond their degree requirements. Those who do stand out as excellent candidates for graduate study. Third, the experience brings you into a close working relationship with a member of the faculty and with graduates students. Such a relationship can be an extraordinary educational experience and can win you a strong advocate (which you will need to get into graduate school or to land a top job).

1.14 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. This seamless transition to graduate study eliminates the need to hit the 133 hr graduation requirement exactly at end of a semester.

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 recom-
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 "simplified entry" program is available for UIUC CEE students starting in Fall 2008. 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 "simplified 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, however, the simplified entry is an attractive option that eliminates the most time-consuming steps involved in the MS application process.

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 warts). 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, then you should retake it until you are certain 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 Civil Engineering Curriculum

2.1 Overview of the Curriculum

The curriculum leading to the degree of Bachelor of Science in Civil Engineering requires 133 hours and is organized into required courses; math, basic science, and engineering science electives; civil engineering technical courses; and other electives. A brief summary of the program follows.

2.1.1 Required Courses (68 hours)

The following courses, associated with 68 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 (0 hours)
- 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) 0 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 286 Intro to Differential Eq Plus (4 hrs) can be substituted

Basic Sciences (20 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
- PHYS 214 Univ Physics, Quantum Phys 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 Mathematics, basic sciences, and engineering sciences electives (6 hours)

Each student must select at least six (6) credit hours of elective courses in mathematics, basic science, or engineering sciences. These electives allow 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 courses should be selected in accord with 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 Undergraduate Advisor or Associate Head for Undergraduate Programs before you can take the course and before you put it on your Academic Program Plan.

2.1.3 Civil engineering technical program (35 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. In fact, that is one way of defining a suitable advanced technical course—it has a core course as a prerequisite (there are one or two exceptions). 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.

The sum of the semester hours of core courses and technical electives must be at least 35.
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:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE 300</td>
<td>Behavior of Materials</td>
<td>4 hrs</td>
</tr>
<tr>
<td>CEE 310</td>
<td>Transportation Engineering</td>
<td>3 hrs</td>
</tr>
<tr>
<td>CEE 320</td>
<td>Construction Engineering</td>
<td>3 hrs</td>
</tr>
<tr>
<td>CEE 330</td>
<td>Environmental Engineering</td>
<td>3 hrs</td>
</tr>
<tr>
<td>CEE 350</td>
<td>Water Resources Engineering</td>
<td>3 hrs</td>
</tr>
<tr>
<td>CEE 360</td>
<td>Structural Engineering</td>
<td>3 hrs</td>
</tr>
<tr>
<td>CEE 380</td>
<td>Geotechnical Engineering</td>
<td>3 hrs</td>
</tr>
</tbody>
</table>

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., sort of like a major field within civil engineering) and a secondary area of emphasis (i.e., sort of like 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 seven 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, and (7) transportation engineering. 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 for Undergraduate Programs or the Undergraduate 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 seven 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 basic 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 seven 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 seven 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 field 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 basic 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 program. (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 benefit 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 Undergraduate Advisor or 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.

There are good reasons and not-so-good reasons for selecting the general option. As an example, a career goal of being a “city engineer” requires broad knowledge of the civil engineering disciplines. The general option would provide an excellent education for such a career goal. The student should not pursue the general option simply because he or she cannot decide on or commit to a primary or secondary. The general option is not general in the sense of leaving one’s options open. It is a specific choice that should be selected based on clear career objectives.

The general option is quite different from the primary/secondary programs. Hence, there may be some unintended consequences to making this choice.

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 generally mean to imply the process of using fundamental engineering principles in the creation of some facility or process that did not previously exist. 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 include 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.

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 Humanities and social science electives and general education requirements (18 hours)

All programs in the College of Engineering require the completion of at least 18 hours of coursework classified as humanities and social sciences. 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 the engineer the broad education necessary for understanding engineering problems and solutions in a global and societal context.

The general humanities and social science requirement of the civil engineering program is not exactly the same as the campus General Education (GenEd) requirement, but, by judiciously selecting courses, the student can meet all of the campus GenEd requirements within the 18 hour requirement of the College of Engineering. There is a complete description of the campus GenEd requirement in Programs of Study. The lists of courses that currently satisfy the campus GenEd requirements can be found on the web at:

http://courses.uiuc.edu/cis/index.html

Although the GenEd requirements are stated in Programs of Study as requirements of hours of credit in the different GenEd areas, some of these hours can overlap (unlike most other graduation requirements involving hours of credit). Observe that more than one GenEd requirement can sometimes be satisfied by a single course (e.g., a course can satisfy the requirements for a course in “Humanities and the Arts” and “Cultural Studies/ Western or Non-western.”)

It is possible to satisfy the campus GenEd requirements with 12 hours of credit. The remaining 6 hours can be taken from the GenEd lists. However, the College of Engineering allows a slightly larger list of courses (i.e., there are courses on the College list that do not satisfy any campus GenEd requirements). The College of Engineering humanities and social science list can be found at the website:
One of the differences between the campus GenEd and College of Engineering humanities and social science lists is that the College allows credit for the study of a foreign language while such study does not satisfy any campus GenEd requirement.

**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.

**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.

**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 133 hours required for a BSCE. 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 133 hour degree requirement. For example, you may take 7 hours of math, basic science, engineering science electives in which case the extra hour is applied toward 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. The prerequisites in the civil engineering curriculum are complicated. For quick reference the prerequisite flow is diagrammed in Fig. 1 below.

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, measured in semesters, advances from left to right in the diagram. Clearly, any course can be taken later that 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.

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 220 → PHYS 211 → TAM 211 → TAM 251 → CEE 360.

The pre-requisite structure of the courses that are post-requisite to the civil engineering core courses are given for each area in Chapter 5.

**2.3 Advice on grades below C**
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
Fig. 1 The prerequisite structure of the required and civil engineering core courses

If 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.

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). Often, both the faculty member and the student adopt a “let’s work out the details later” approach to starting an independent study. Such an approach can result in problems for all involved that can easily be avoided with careful planning up front and clear communication throughout the project.

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 in the administrative office of the department (1114 Newmark Civil Engineering Laboratory).

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 very 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. Because independent studies often run over the semester boundaries, we recommend that you do not undertake an independent study in your last semester.

**Special topics course (CEE 498).** The special topics course provides a mechanism to easily introduce new courses into the curriculum. These courses are designated as “experimental courses” because they have not been through the careful review process required of permanent courses on this campus (a process that can take over a year to complete). In general, these courses are ordinary classroom courses and the student should expect them to function in the normal way.

Some of the civil engineering disciplines rely on special topics courses to fill out 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 of the area which offers the course, even though they do not appear on the list of recommended courses. In general, they cannot be used to replace a required course in the area. These courses will not necessarily be accepted as an advanced technical course in an area different from the one offering the course.

Notices of special topics courses may be posted or otherwise distributed. You can always learn of the courses available by looking at the listing at [http://courses.uiuc.edu/cis/index.html](http://courses.uiuc.edu/cis/index.html).
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 312 Route Surveying 1.50
- 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 400 Welding and Joining Processes 2.00
- 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 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 437 Water Quality Engineering 1.50
- CEE 440 Solid and Hazardous Waste 1.00
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE 442</td>
<td>Env Eng Principles, Physical</td>
<td>0.50</td>
</tr>
<tr>
<td>CEE 443</td>
<td>Env Eng Principles, Chemical</td>
<td>0.00</td>
</tr>
<tr>
<td>CEE 444</td>
<td>Env Eng Principles, Biological</td>
<td>0.00</td>
</tr>
<tr>
<td>CEE 445</td>
<td>Air Quality Modeling</td>
<td>0.60</td>
</tr>
<tr>
<td>CEE 446</td>
<td>Air Quality Engineering</td>
<td>2.00</td>
</tr>
<tr>
<td>CEE 447</td>
<td>Atmospheric Chemistry</td>
<td>0.00</td>
</tr>
<tr>
<td>CEE 449</td>
<td>Environmental Engineering Lab</td>
<td>2.00</td>
</tr>
<tr>
<td>CEE 450</td>
<td>Surface Hydrology</td>
<td>0.75</td>
</tr>
<tr>
<td>CEE 451</td>
<td>Environmental Fluid Mechanics</td>
<td>0.60</td>
</tr>
<tr>
<td>CEE 452</td>
<td>Hydraulic Analysis and Design</td>
<td>2.50</td>
</tr>
<tr>
<td>CEE 453</td>
<td>Urban Hydrology and Hydraulics</td>
<td>2.70</td>
</tr>
<tr>
<td>CEE 457</td>
<td>Groundwater</td>
<td>0.25</td>
</tr>
<tr>
<td>CEE 460</td>
<td>Steel Structure, I</td>
<td>2.40</td>
</tr>
<tr>
<td>CEE 461</td>
<td>Reinforce Concrete, I</td>
<td>2.40</td>
</tr>
<tr>
<td>CEE 462</td>
<td>Steel Structures, II</td>
<td>2.40</td>
</tr>
<tr>
<td>CEE 463</td>
<td>Reinforced Concrete, II</td>
<td>2.25</td>
</tr>
<tr>
<td>CEE 465</td>
<td>Design of Structural Systems</td>
<td>3.00</td>
</tr>
<tr>
<td>CEE 467</td>
<td>Masonry Structures</td>
<td>2.40</td>
</tr>
<tr>
<td>CEE 468</td>
<td>Prestressed Concrete</td>
<td>2.40</td>
</tr>
<tr>
<td>CEE 469</td>
<td>Wood Structures</td>
<td>2.40</td>
</tr>
<tr>
<td>CEE 470</td>
<td>Structural Analysis</td>
<td>1.00</td>
</tr>
<tr>
<td>CEE 471</td>
<td>Structural Mechanics</td>
<td>0.30</td>
</tr>
<tr>
<td>CEE 472</td>
<td>Structural Dynamics</td>
<td>1.00</td>
</tr>
<tr>
<td>CEE 480</td>
<td>Foundation Engineering</td>
<td>2.25</td>
</tr>
<tr>
<td>CEE 483</td>
<td>Soil Mechanics and Behavior</td>
<td>1.50</td>
</tr>
<tr>
<td>CEE 484</td>
<td>Applied Soil Mechanics</td>
<td>2.50</td>
</tr>
<tr>
<td>CEE 490</td>
<td>Computer Methods</td>
<td>1.50</td>
</tr>
<tr>
<td>CEE 491</td>
<td>Decision and Risk Analysis</td>
<td>1.50</td>
</tr>
<tr>
<td>CEE 495</td>
<td>Professional Practice</td>
<td>0.00</td>
</tr>
<tr>
<td>CEE 497</td>
<td>Independent Study*</td>
<td>0.00</td>
</tr>
<tr>
<td>CEE 498</td>
<td>Special Topics*</td>
<td>0.00</td>
</tr>
</tbody>
</table>

* Design content in CEE 497 and CEE 498 is assigned to be zero. The design content in these courses (and courses outside CEE) is evaluated on a case-by-case basis as needed to support a waiver of the design content requirement. The petition for a waiver need only be done by those students who do not meet the design content requirement independent of design content of the CEE 497 or CEE 498 courses. 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 400 Welding and Joining Processes
- CEE 401 Concrete Materials
- CEE 405 Asphalt Materials, I
- CEE 449 Environmental Engineering
- CEE 483 Soil Mechanics and Behavior
- CEE 498 FM Water Resources Field Methods
- CEE 498 KUC Experimental Methods in Structures and Materials

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

Special topics courses are offered each semester. Some eventually become permanent courses, some do not. Courses that have been offered recently include:

- CEE 498 BP Biological Principals
- CEE 498 BSM Environmental Risk Assessment and Management
- CEE 498 EM Mathematical Modeling of Microbial Processes in Environ Eng
- CEE 498 FM Field Methods in Hydrology
- CEE 498 KUC Experimental Methods in Structures and Materials
- CEE 498 RC Railroad Track Engineering
- CEE 498 RD Railroad System Planning and Design
- CEE 498 RT Railway Transportation Engineering
- CEE 498 RO Railroad Signaling and Control
- CEE 498 SH Sustainable Housing
- CEE 498 SUE Sustainable Urban Engineering
- CEE 498 WCS Design of Waste Containment Systems
3
The 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, but it is not sufficient. 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 Undergraduate Advisor in consultation with 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 letter to the student and the academic advisor 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.

When necessary, the Undergraduate Advisor will work with the student, the advisor, and the faculty in the primary or secondary field to get to an acceptable Academic Program Plan. Disapproval of the Academic Program Plan is used only in those cases in which the student and the Undergraduate advisor are unable to reach an accord on an acceptable set of courses.

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). 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 from the Undergraduate Advisor before you submit your plan (see Section 3.7).

An accepted Academic Program Plan can be superceded 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 basic 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 semester following successful completion of 75 credit hours toward the civil engineering degree. For normal progress, this time corresponds with the second semester of the junior 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 (or any revision of it), with your signature and the signature of your advisor, to Becky Borden in the department office: (1114 Newmark Civil Engineering Laboratory).

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 Undergraduate 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 Academic Affairs office in the College of Engineering is responsible for approving all degrees. As such, they monitor the progress of each student in the college and report on that progress through a service called the **Degree Audit or DARS**.

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 data is updated periodically so the degree audit should always be accurate and up to date.

The degree audit is important because it gives the view from the Academic Affairs office—the office that administers and ultimately approves your degree—on the progress toward your degree. If there are errors or discrepancies on your degree audit you should bring them to the attention of the Academic Affairs immediately. They can work with you to resolve any clerical problems. Students can access their degree audit at the website listed.

http://www.oar.uiuc.edu/current/dars/index.html

The degree audit gives a “snapshot date” (the most recent update of the records that affect your case) and your major (CIVIL ENGINEERING). The degree audit also 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 BASIC SCIENCE ELECTIVES (Section 2.1.2)

SOCIAL SCIENCE AND HUMANITIES (Section 2.1.4)

The degree audit indicates by a plus (+) those courses you have completed and by a greater than sign (>1) 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). For the other sections of the degree audit there is no ambiguity associated with how credit is earned.

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 Advisor.

3.6 Going above and beyond the program requirements

The graduation requirements outlined in Chapter 2 are minimal requirements. Most people try to hit the minimum right down to the hour, and lament those hours of study that go beyond the minimal requirements. There is nothing wrong with getting more education than the minimum and we encourage you to spread your wings while you are here. This may be your last chance to encounter certain subjects. There are, however, some important issues concerned with the Academic Program Plan and certain courses that go above and beyond the minimal 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 credit 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 someday use it for graduate credit. The extra course will always be on your transcript so the record that you took it (and how well you did) is always there. It does not have to (and, indeed, should not) appear on your Academic Program Plan.

### 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. If a student’s program plan includes one of the special courses and is short of the 16 hour requirement on design content, then the student may request a waiver of the design content requirement. Such a waiver can be granted only by the Associate Head of Civil and Environmental Engineering in charge of undergraduate programs. The request for a waiver of the design requirement must include: (1) a letter or email from the instructor of the CEE 497 or CEE 498 course describing the design content of that course, (2) a note in the section *Explanatory Notes and Comments* on the back of the Academic Program Plan, written by the student, making the case for the waiver, and (3) a note in the section *Advisor Comments* on the back of the Academic Program Plan, written by the faculty advisor, arguing for or against the proposed waiver.

Some guidance on why you might want to take an independent study course or a special topics courses is given in Chapter 2, The Civil Engineering Curriculum.
## 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.

<table>
<thead>
<tr>
<th>First Year</th>
<th>Hours</th>
<th>First Semester (14 or 15 hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>CEE 195—About Civil Engineering$^1$</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>CHEM 102—General Chemistry I</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>CHEM 103—General Chemistry Lab I</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>ENG 100—Engineering Lecture</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>MATH 221—Calculus I$^3$</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Social science and humanities electives</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>GE 101—Engineering Graphics &amp; Design$^2$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[OR RHET 105—Principles of Composition (4hr)]</td>
</tr>
<tr>
<td>Hours</td>
<td></td>
<td>Second Semester (17 or 16 hours)</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>CHEM 104—General Chemistry II</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>CHEM 105—General Chemistry Lab II</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>MATH 225—Introductory Matrix Theory$^4$</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>MATH 231—Calculus II</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>PHYS 211—Univ Physics, Mechanics</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>RHET 105—Principles of Composition$^2$</td>
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<tr>
<td></td>
<td></td>
<td>[OR GE 101—Engineering Graphics &amp; Design (3hr)]</td>
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<table>
<thead>
<tr>
<th>Second Year</th>
<th>Hours</th>
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<tr>
<td></td>
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<td>CS 101—Intro to Computing, Eng &amp; Sci</td>
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<td></td>
<td>4</td>
<td>MATH 241—Calculus III</td>
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<td></td>
<td>4</td>
<td>PHYS 212—Univ Physics, Elec &amp; Mag</td>
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<tr>
<td></td>
<td>3</td>
<td>TAM 211—Statics</td>
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<tr>
<td></td>
<td>3</td>
<td>Social science and humanities electives</td>
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</table>

<table>
<thead>
<tr>
<th>Hours</th>
<th>Second Semester (16 hours)</th>
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<tbody>
<tr>
<td>3</td>
<td>CEE 201—Systems Engrg &amp; Economics</td>
</tr>
<tr>
<td>3</td>
<td>CEE 202—Engineering Risk &amp; Uncertainty</td>
</tr>
<tr>
<td>2</td>
<td>PHYS 213—Univ Physics, Thermal Physics</td>
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<tr>
<td>2</td>
<td>PHYS 214—Univ Physics, Quantum Physics</td>
</tr>
<tr>
<td>3</td>
<td>TAM 212—Introductory Dynamics</td>
</tr>
<tr>
<td>3</td>
<td>TAM 251—Introductory Solid Mechanics</td>
</tr>
</tbody>
</table>
### Third Year

**Hours**  
First Semester *(17 hours)*  
3 MATH 285—Intro Differential Equations  
4 TAM 335—Introductory Fluid Mechanics  
7 Civil engineering core courses  
3 Mathematics, basic science, or engineering science electives

**Hours**  
Second Semester *(18 hours)*  
3 BTW 261—Principles Tech Comm  
6 Civil engineering core courses  
3 Mathematics, basic science, or engineering science electives  
3 Advanced technical electives  
3 Social science and humanities electives

### Fourth Year

**Hours**  
First Semester *(18 hours)*  
0 CEE 495—Professional Practice  
3 Civil engineering core courses  
3 Free electives  
6 Social science and humanities electives  
6 Advanced technical electives

**Hours**  
Second Semester *(16 hours)*  
3 Free electives  
3 Social science and humanities electives  
10 Advanced technical electives

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**Footnotes**

1. CEE 195 taken first 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 a mathematics minor.

5. MATH 286 (4 hours) can be substituted for Math 285 (3 hours).

6. Mathematics, basic science, and engineering science electives are 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 offered only in the Fall semester.
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, and Transportation Systems Engineering.

The secondary fields can be chosen either as one of the seven civil engineering disciplines (different from the primary) or one of a number of other possibilities. 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 basic 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 junior 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 academic advisor or the Undergraduate Advisor is probably your best resource for sorting out this important career decision.

Note that, for a given primary or secondary, you must select courses from the recommended list if required courses do not consume all of the hours needed. Deviations from this practice are subject to the approval of the Program Review Committee.

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

Mathematics, Basic Science, and Engineering Science

Required: None
Recommended: ATMS 120, ECE 205, GE 498 EGE, GEOL 107, 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 400, 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

Note: Check current offerings of Special Topics courses (CEE 498) for other advanced technical courses in this area.
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

Mathematics, Basic Science, and Engineering Science
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
Recommended: CEE 310, CEE 360, CEE 380

Advanced Technical Courses
Required: CEE 400, CEE 401, CEE 405
Recommended: CEE 406, CEE 460, CEE 461, CEE 469, CEE 483, 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 400, CEE 401, CEE 405

Prerequisite structure for advanced courses in this field

Note: Check current offerings of Special Topics courses (CEE 498) for other advanced technical courses in this area.
5.5 Environmental Engineering

Environmental engineers have taken an increasingly important role in activities of the world in recent years, because of the problems related to air, land, and water contamination. Environmental engineers provide treatment facilities that render industrial and human wastes free from contaminants. They design, construct, and operate systems that purify water for drinking, industrial, and recreational uses. They also develop and implement air purification devices and models that describe the transport, and removal of contaminants in the atmosphere. Solid and hazardous waste management protocols are also developed and implemented by environmental engineers. Many environmental engineers develop plans and conduct research to solve problems related to our rapidly changing technological society and expanding human population.

Primary in Environmental Engineering

**Mathematics, Basic Science, and Engineering Science**
- Required: None
- Recommended: CHEM 222, CHEM 232, CS 257, GEOL 107, MCB 300, ME 300, MSE 401, STAT 420,

**Civil Engineering Core Courses**
- Required: CEE 330, CEE 350
- Recommended: CEE 380

**Advanced Technical Courses**
- Required: At least one of (CEE 437, CEE 440, CEE 446)
- Recommended: CEE 430, CEE 434, CEE 442, CEE 443, CEE 444, CEE 445, CEE 447, CEE 449
  CEE 452, CEE 453, CEE 457

Secondary in Environmental Engineering

**Civil Engineering Core Courses**
- Required: CEE 330

**Advanced Technical Courses**
- Required: Two from the recommended list
- Recommended: CEE 430, CEE 434, CEE 437, CEE 440, CEE 445, CEE 446, CEE 447, CEE 449

Prerequisite structure for advanced courses in this field

Note: Check current offerings of Special Topics courses (CEE 498) for other advanced technical courses in this area.
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

**Mathematics, Basic Science, and Engineering Science**
Required: None
Recommended: CS 257, 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**

![Prerequisite structure diagram]

Note: Check current offerings of Special Topics courses (CEE 498) for other advanced technical courses in this area.
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 geoenvironmental 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

Mathematics, Basic Science, and Engineering Science
Required: GEOL 107
Recommended: GEOL 108, 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

Note: Check current offerings of Special Topics courses (CEE 498) for other advanced technical courses in this area.
5.8 Structural Engineering

Structural engineering involves the design and erection 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 failed 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 the creation, maintenance, or demolition of constructed facilities. The largest of structures, such as the Golden Gate Bridge, Hoover Dam, and the Eiffel Tower, stand as monuments to the achievements of humankind. The smallest of structures, such as the thin films that contain computer circuitry, make possible many devices in our technologically sophisticated society.

Primary in Structural Engineering

**Mathematics, Basic Science, and Engineering Science**

- Required: None
- Recommended: CS 257, 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

Note: Check current offerings of Special Topics courses (CEE 498) for other advanced technical courses in this area.
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

Mathematics, Basic Science, and Engineering Science

Required: None
Recommended: CS 257, (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 two courses, each from a different Area*) and two from the recommended list.)

* Area 1 - Facilities: CEE 405, CEE 406
* Area 2 - Systems: CEE 415, CEE 416
* Area 3 - Railroad: CEE 498 RC, CEE 498 RT
Recommended: CEE 400, CEE 401, CEE 405, CEE 406, CEE 415, CEE 416, CEE 480, CEE 498 RC, CEE 498 RD, CEE 498 RO, CEE 498 RT

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 498 RC, CEE 498 RD
Recommended: CEE 498 RO, CEE 498 RT

Prerequisite structure for advanced courses in this field

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Prerequisite

CEE 310

CEE 405

CEE 406

CEE 415

CEE 416

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Note: Check current offerings of Special Topics courses (CEE 498) for other advanced technical courses in this area.
5.10 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 programs.

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, Basic Science, and Engineering Science electives are given for these secondaries. 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 401*, ATMS 402, ATMS 403, ATMS 410, ATMS 411, CEE 447

**Chemistry**

Primary field: Environmental Engineering

*Civil Engineering Core Courses*

Required: CEE 330

*Advanced Technical Courses*

Recommended: CHEM 233, CHEM 315/420, CHEM 332, 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

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* These courses are the most important among those recommended and form the core of this secondary field proposal. As always, please check prerequisites for all courses.
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
5.11 The General Civil Engineering Option

The General Option was created to recognize that there are career outcomes in civil engineering for which great breadth of understanding of all aspects of civil engineering has merit over specialization. For example, a city engineer handles all engineering problems related to maintaining the infrastructure of a city. These problems can, and often do, involve all of the disciplines of civil engineering and, in many cases, require a clear understanding of the interactions among them. Although depth of knowledge in any or all of these fields may be desirable for a professional with these kinds of responsibilities, there is clear benefit to the breadth.

The General Option should be elected for its merits relative to a career outcome similar to the one described above. It should not be elected to keep career options open or to avoid or delay making a career decision—the General Option is a career decision.

The requirements of the General Option

Mathematics, Basic Science, and Engineering Science

Required: Two from recommended list
Recommended: GEOL 107, CHEM 222, CHEM 232, ME 300, STAT 420

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 35 hours.
Option II: Pick two courses from one area, and no more than one course from the remaining areas until reaching 35 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 400, CEE 401
- Structures: CEE 460, CEE 461
- Transportation: CEE 405, CEE 406, 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 and CEE 483 which are four 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 all of 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. 0 hours.

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 342. 3 hours.

300. Behavior of Materials. Same as TAM 324. Mechanical behavior or 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.
312. **Route Surveying.** Principles for the design and layout of routes; coverage includes horizontal and vertical alignment, route location, earthwork, computation, ground and photogrammetric survey methods, and special survey methods for highways, railroads, pipelines, tunnels and urban construction. *Prerequisite:* CEE 311. 3 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.

400. **Welding and Joining Process.** Same as MSE 444. The physical principles of fusion welding; heat flow; thermal cycles; physical metallurgy and mechanical properties of welded joints; applications of welding to large structures; testing of welds; nondestructive testing; design, economics, and weld specifications; and laboratory experiments in welding. *Prerequisite:* TAM 324 or 206. 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.
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.

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. Solid and Hazardous Waste. 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. 3 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 relating 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. 3 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.

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.** 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.**
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 in accord with 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 filled out in ink.

### Mathematics, Basic Science, and Engineering Science Electives (6 hours min)
Select in accord with requirements and recommendations of the chosen primary field.

### Civil Engineering Technical Courses
(Core courses + Advanced courses = 35 hours min)

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

**Notes:** Traditional program with a 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 a 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. Note deviations from pre-approved programs in the Undergraduate Handbook.

### Required Signatures

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<th>Role</th>
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<tr>
<td>Student</td>
<td>John Q. Student</td>
<td>jstudent</td>
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<td>Faculty Advisor</td>
<td>J. M. Advisor</td>
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<td>Program Review Committee</td>
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<td>Associate Head of Civil and Environmental Engineering</td>
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### Summary Program Requirements

- **Total CEE technical credit** (Core + Advanced Courses): 36
- **Total Design credit** (Sum of all design hours): 15.85
- **Integrated design course** (Give course number): CEE 465
- **Laboratory course** (Give course number): CEE 300

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You can pick up an Academic Program Plan form in 1114 Newmark Civil Engineering Laboratory.
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 any 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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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).