Student Guide to

Senior Plan of Study Electives Senior Design, Licensure, and Graduate School

Bachelor of Science in Civil Engineering
Bachelor of Science in Architectural Engineering
Bachelor of Science in Construction Engineering
Bachelor of Science in Environmental Engineering

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Table of Contents

Senior Plan of Study Electives – What You Should Consider

Choosing your senior plan of study electives deserves careful consideration and planning. The selection of your senior electives can have a dramatic effect on your early career options. You can choose to gain a broad exposure to a variety of areas, or you may opt to focus your electives in a particular area. To help, you should carefully review the course descriptions provided later in this guide.

In addition to interest and career options, you need to consider the following:

- You must adhere to the degree program rules for your senior plan of study electives. Each degree program has its own set of rules for the senior plan of studies.
- You are required to take ether, CE 401 or CE 403, each having its own set of prerequisites. Which course you take will affect your selection of senior plan of study electives. The following section provides additional information about each course and its prerequisites.
- You are encouraged to consider taking 500-level courses as part of your Bachelors degree if you have at least a 3.0 or higher GPA. If you are in the Honors College, 500-level courses are considered honors courses. Please see later section on "Seniors Taking Graduate Courses."
- If you have a 3.3 or higher GPA, you are also invited to participate in our **University Scholars Program** where you can take up to three 500- or 600-level courses and have them double count towards both your Bachelors degree and your MS degree. Please see "University Scholars Program – Get a Jump Start on Graduate School" later in this guide.

Approved Senior Plan of Study Electives for Each Degree Program

As you plan out what to take for your senior plan of study electives you need know what courses are approved as electives for each degree program. If you have a 3.0 or higher overall GPA you may, with permission, take 500-level courses as part of your senior coursework. With a 3.3 or higher GPA you may participate in the University Scholars (BS/MS) Program and to take 500- and/or 600-level electives (600-level courses can only be taken as part of the University Scholars Program).

BS in Civil Engineering – Approved Electives for the BSCivE

You must complete six approved senior plan of study electives (18 credit hours), including

1. At least two of the following approved design (D) CE electives (you may take more than two):
   - CE 424 or CE 524* Water and Wastewater Treatment
   - CE 425 or CE 525* Air Quality Engineering
   - CE 433 Reinforced Concrete Structures I
   - CE 434 Structural Steel Design I
   - CE 435 or CE 535* Concrete Materials
   - CE 437 or CE 537* Reinforced Concrete Structures II
   - CE 438 or CE 538* Structural Steel II
   - CE 439 Wood and Masonry Structures
   - CE 442 or CE 542* Waste Containment Facilities
   - CE 444 or CE 544* Foundation Engineering
   - CE 451 Geometric Design of Roadways
   - CE 459 or CE 559* Pavement Design and Rehabilitation
   - CE 461 or CE 561* Horizontal Construction Methods
   - CE 462 or CE 562* Vertical Construction Methods
   - CE 475 or CE 575* Hydrology
   - CE 480 or CE 580* Forensic Engineering
   - CE 485 or CE 585* Construction Site Erosion Control
   - CE 536* Wood Structural Design
   - CE 543* Prestressed Concrete Structures
   - CE 570* Open Channel Flow

* Students with a 3.0 or higher overall GPA may take 500-level courses with permission.

2. Up to four of the following general technical (G) CE electives (you need not take any):
   - CE 420 Environmental Measurements
   - CE 422 or CE 522* Solid and Hazardous Waste Management
   - CE 432 or CE 532* Matrix Analysis of Structures
   - CE 454 or CE 554* Urban Transportation Planning
   - CE 458 Traffic Engineering
   - CE 464 or CE 564* Safety Engineering
   - CE 470 Water Resources in the European Alps (study abroad)
   - CE 486 or CE 586* GIS for Civil Engineers
   - CE 491 or CE 591* Special Problems (with approval)
   - CE 498 Undergraduate Research (with approval)
   - CE 521* Environmental Engineering Microbiology
   - CE 531* Structural Dynamics
   - CE 533* Structural Loads
   - CE 534* Advanced Structural Mechanics
   - CE 541* Wind and Earthquake Engineering
   - CE 553* Intelligent Transportation Systems
   - CE 556* Transportation System Analysis
   - CE 573* Statistical Applications in Civil Engineering
   - CE 624** Water Quality Modeling
   - CE 626* Physical and Chemical Processes
   - CE 631* Experimental Structural Dynamics
   - CE 633** Structural Reliability
   - CE 635** Analytical Methods in Cement and Concrete
   - CE 636** Advanced Infrastructure Materials
   - CE 640** Earthquake Engineering
   - CE 641** Wind Engineering
   - CE 655** Sustainable Transportation
   - CE 656** Transportation Demand and Network Modeling
   - CE 658** Traffic Flow Theory
   - CE 671** Hydrologic Modeling
   - CE 691** Special Problems (with approval)
   - CE 686* Advanced GIS
3. No more than two of the following professional practice (P) CE electives (you need not take any):
   - CE 414 or CE 515* Information Systems Design
   - CE 415 or CE 515* Advanced Engineering Economics
   - CE 417 or CE 517* Advanced Project Management
   - CE 418 or CE 518* Engineering Management
   - CE 463 or CE 563* Construction Cost Estimating
   - CE 467 or CE 567* Construction Accounting and Finance
   - CE 468 or CE 568* Construction Scheduling
   - CE 481 or CE 581* Legal Aspects in Engineering and Construction
   - CE 560* Front End Planning
   - CE 616** Advanced Information Systems
   - AEM 452 Composite Materials
   - ECE 320 Fundamentals of Electrical Engineering (if ME 216 is taken for degree)
   - EN 319 Technical Writing
   - FI 302 Business Finance
   - GES 401 or GES 501 Operations Research
   - MATH 300 Introduction to Numerical Analysis

* Students with a 3.0 or higher overall GPA may take 500-level courses with permission.
**Students in the University Scholars Program may take 500- or 600-level courses with permission.

- ME 309 Heat Transfer
- ME 407 Heating, Ventilation and Air Conditioning
- ME 416 Energy Conservation and Management
- MGT 386 Foundations of Entrepreneurship
- MKT 410 Managing Innovation
- MTE 455 Mechanical Behavior of Materials
- MTE 487 Corrosion Science and Engineering
- Other 300- and 400-level non-CE courses may be accepted as professional practice (P) electives. See your advisor for more information on how to petition for approval of other non-CE courses as a P elective.

BS in Construction Engineering – Approved Electives for the BSConE

You must complete three approved senior plan of study electives (9 credit hours), including

1. At least one of the following approved construction design (CD) CE electives (you may take more):
   - CE 378 Water Resources Engineering
   - CE 433 Reinforced Concrete Structures I
   - CE 434 Structural Steel Design I
   - CE 435 or CE 535* Concrete Materials
   - CE 437 or CE 537* Reinforced Concrete Structures II
   - CE 438 or CE 538* Structural Steel II
   - CE 439 Wood and Masonry Structures
   - CE 442 or CE 542* Waste Containment Facilities
   - CE 444 or CE 544* Foundation Engineering
   - CE 459 or CE 559* Pavement Design and Rehabilitation
   - CE 480 or CE 480* Forensic Engineering
   - CE 485 or CE 585* Construction Site Erosion Control
   - CE 536* Wood Structural Design
   - CE 543* Prestressed Concrete Structures Engineering
   - In addition to the above construction design (CD) electives, the following construction design courses are required in the BSConE curriculum: CE 461/561 and CE 462/562.
2. At least one of the following approved project management (PM) CE electives (you may take more):
   - CE 414 or CE 515* Information Systems Design
   - CE 415 or CE 515 Advanced Engineering Economics
   - CE 417 or CE 517* Advanced Project Management
   - CE 467 or CE 567* Construction Accounting and Finance
   - CE 481 or CE 581* Legal Aspects in Engineering and Construction
   - CE 560* Front End Planning
   - CE 616** Advanced Information Systems
   - EN 319 Technical Writing
   - FI 302 Business Finance
   - GES 401 or GES 501 Operations Research
3. Up to one of the following general technical (GT) CE electives (you need not take any):
   - CE 350 Introduction to Transportation Engineering
   - CE 432 or CE 532* Matrix Analysis of Structures
   - CE 491 or CE 591* Special Problems (with approval)
   - CE 498 Undergraduate Research (with approval)
   - CE 533* Structural Loads
   - CE 573* Statistical Applications in Civil Engineering

* Students with a 3.0 or higher overall GPA may take 500-level courses with permission.
** Students in the University Scholars Program may take 500- or 600-level courses with permission.

BS in Architectural Engineering – Approved Electives for the BSArchE

You must complete three approved senior plan of study electives (9 credit hours) from the following list:

- CE 414 or CE 514 Information Systems Design
- CE 417 or CE 517 Advanced Project Management
- CE 432 or CE 532 Matrix Analysis of Structures
- CE 437 or CE 537* Reinforced Concrete Structures II (design elective)
- CE 438 or CE 538* Structural Steel II (design elective)
- CE 439 Wood and Masonry Structures (design elective)
- CE 444 or CE 544* Foundation Engineering (design elective)
- CE 463 or CE 563 Construction Cost Estimating
- CE 468 or CE 568 Construction Scheduling
- CE 536* Wood Structural Design (design elective)
- CE 543* Prestressed Concrete Structures (design elective)
- CE 481 or CE 581* Legal Aspects of Engineering and Construction
- CE 491 or CE 591* Special Problems (with approval)
- CE 498 Undergraduate Research (with approval)
- CE 531* Structural Dynamics
- CE 533* Structural Loads
- CE 560 Front End Planning
- CE 573* Statistical Applications in Civil Engineering
- CE 631** Experimental Structural Dynamics
- CE 633** Structural Reliability
- CE 640** Earthquake Engineering
- CE 641** Wind Engineering
- ECE 451 Power Electronics
- ECE 453 Power and Systems
- EN 319 Technical Writing
- ME 309 Heat Transfer
- ME 416 Energy Conservation and Management
- The BSArchE curriculum requires the following design courses: CE 433, CE 434, and CE 462/562. While there is no requirement to complete any additional design electives, electives with significant design experience are noted above as a "design elective."

BS in Environmental Engineering – Approved Electives for the BSEnvE

You must complete three approved senior plan of study electives (9 credit hours) from the following list:

- CE 366 Introduction to Construction Engineering
- CE 442 or CE 542* Waste Containment Facilities (design elective)
- CE 470 Water Resources in the European Alps (study abroad)
- CE 480 or CE 580* Forensic Engineering (design elective)
- CE 481 or CE 581* Legal Aspects in Engineering and Construction
- CE 485 or CE 585* Construction Site Erosion Control
- CE 486 or CE 586* GIS for Civil Engineers
- CE 491 or CE 591* Special Problems (with approval)
- CE 498 Undergraduate Research (with approval)
- CE 521* Environmental Engineering Microbiology
- CE 570* Open Channel Flow (design elective)
- CE 573* Statistical Applications in Civil Engineering
- CE 624** Water Quality Modeling (design elective)
- CE 626** Physical and Chemical Processes

* Students with a 3.0 or higher overall GPA may take 500-level courses with permission.
**Students in the University Scholars Program may take 500- or 600-level courses with permission.

- CE 671** Hydrologic Modeling
- CE 686** Advanced GIS
- BSC 300 Cell Biology
- BSC 340 Principles of Natural Resources Conservation
- CH 231 Elementary Organic Chemistry I
- CHE 440 Health and Safety in Chemical Process Industries
- EN 319 Technical Writing
- GEO 306 Hydrogeology
- GEO 410 Soil and Groundwater Restoration
- GY 402 Climatology
- GY 413 Applied Climatology
- NEW 365 or PSC 365 Introduction to Environmental Policy
- ST 451 Statistical Methods in Research II
- The BSEnvE curriculum requires the following design courses: CE 424/524, CE 425/525, and CE 475/575. While there is no requirement to complete any additional design electives, electives with significant design experience are noted above as a "design elective."

Engineering Design – What Constitutes Design

Engineering design is a creative, systematic, and often iterative application of scientific, mathematical, and basic engineering principles to conceive and develop components, systems, and processes in response to a defined need. Engineering creativity is fueled by ideas and knowledge of technology. Engineering design includes a consideration of multiple criteria -- economic, health and safety, social and environmental, and appropriate measures of functionality and performance -- as well as applicable codes, standards, and regulations. The engineering design process is made up of several stages, which may include identification of need, definition of scope and constraints, definition of design problem statements and applicable codes and standards, iteration between synthesis and analysis of design alternatives, selection of the best design based on applicable criteria, and documentation. A more in-depth definition of engineering design and the engineering design process is, to a certain extent, engineering-discipline specific. That is, the process to design a water filtration system may share elements with the process to design a building's structural system, but the two design processes diverge in many specifics.


CIVIL, CONSTRUCTION, AND ENVIRONMENTAL
ENGINEERING

Senior Design – Selecting the Right One for You

Senior design is a team-based, multidisciplinary design project that requires you to draw upon all previous coursework, as well as other related experiences. The department offers two different senior design options depending on your interest and major, CE 401 Capstone Project – Site Design and CE 403 Capstone Project – Building Design. BSCivE and BSConE students may chose either CE 401 or 403 (making sure they meet the prerequisites). BSArchE students must take CE 403, and BSEnvE students must take CE 401.

CE 401 Site Design – You should consider taking either CE 401 if you are interested in transportation and roadway design and construction; soils and geotechnical engineering; environmental and water resource design; and cost estimating and scheduling. This course provides the opportunity to apply your theoretical knowledge to real-world projects. You will work with industry partners who are consulting engineers with diverse backgrounds and technical expertise. Your project will be in a group setting that fosters teamwork and partnerships, and it will mimic a consulting engineering firm's approach to project planning and designing. This class will deepen your knowledge and application of AutoCAD Civil 3-D as well as enrich your public speaking and presentation skills, which are key to getting ahead of other college graduates and preparing to enter the job market.

CE 403 Building Design – You should consider taking either CE 403 if you are interested in the design and construction of structures such as buildings, bridges and foundations. You will work closely with practicing consulting engineers and architects, with special lectures from the construction and engineering community. These industry partners provide assistance and direction as your project develops. The course uses a team-design concept that mimics a small, multidisciplinary engineering firm to produce and present your design. The architectural aspects add an understanding of why a building takes a particular form and include building code issues such as egress, occupancy, building use and programming of usable space. The added application of AutoCAD and, additionally, the use of Revit in building design, combined with the communication and presentation skills development of this course has the potential of setting you apart from other graduates.

Senior Design Course Pre- and Co-Requisites

	CE 401 (satisfy either set of prerequisites)		**CE 403**
	Prerequisite Set Option A	**Prerequisite Set Option B**	
Prerequisite Courses Required (*You must complete prior to taking senior design*)	• CE 320; • CE 378; • CE 340 or CE 350; • Any two 400- or 500-level CE courses	• CE 340; • CE 366; • CE 320, CE 350 or CE 378; • Any two 400- or 500-level CE courses	• CE 331; • CE 340; • CE 366; • Any two 400- or 500-level CE courses
Corequisite Design Courses; Select Two (*You may take prior to or concurrent with senior design*)	• CE 424 or CE 524 • CE 425 or CE 525 • CE 442 or CE 542 • CE 451 • CE 459 or CE 559 • CE 475 or CE 575 • CE 485 or CE 585	• CE 442 or CE 542 • CE 459 or CE 559 • CE 461 or CE 561 • CE 485 or CE 585	• CE 433 • CE 434 • CE 437 or CE 537 • CE 438 or CE 538 • CE 439 • CE 444 or CE 544 • CE 462 or CE 562 • CE 536 • CE 543

Department Minors – Why You Might Consider a Minor

A minor is not required, but a minor can help you focus your electives and allow you to easily demonstrate to a prospective employer that you have an interest and depth of study in a particular area. The Department offers six different minors, which you may consider as a complement to your degree. Courses taken as part of your degree can also count towards your minor, and vice versa. The requirements for each of the Department's minors are as follows:

Minor in Architectural Engineering (not open to students pursuing the BSArchE)	• Required Courses (10 credit hours): CE 331, CE 366, and CE 403 • Electives (12 credit hours): Select a minimum of one elective from at least two of the following areas: Structural Engineering and Design – CE 432/532, CE 433, CE 434, CE 436/536, CE 437/537, CE 438/538, CE 444/544, and CE 439/539 Building Mechanical/Electrical Systems – ME 309, ME 407, ME 416, and ECE 350 Construction Engineering and Management – CE 467/567, CE 468/568, CE 417/517, and CE 418/518
Minor in Civil Engineering (not open to students pursuing the BSCivE)	• Required Courses (19 credit hours): CE 320, CE 331, CE 340, CE 350, CE 366, and CE 378 • Electives (6 credit hours): two approved civil engineering senior (400- or 500-level) electives
Minor in Construction Engineering (not open to students pursuing the BSConE)	• Required Courses (12 credit hours): CE 366, CE 464, CE 461/561* or CE 462/562*, and CE 463/563* or CE 468/568* • Electives (6 credit hours): CE 414/514, CE 415/515, CE 416/516, CE 417/517, CE 418/518, CE 461/561*, CE 462/562*, CE 463/563*, CE 466/566, CE 468/568*, CE 480/580, CE 481/581, CE 485/585, GES 401/501, ME 425, ME 407, ME 416, LGS 408, and FI 432 * Students may take both CE 461/561 and CE 462/562, and/or both CE 463/533 and CE 468/568 to satisfy the requirements of the minor
Minor in Environmental and Water Resources Engineering (not open to students pursuing the BSEnvE)	• Required Courses (12 credit hours): CE 320, CE 378, CE 422/522, and CE 425/525, • Electives (6 credit hours): CE 220, CE 423/523, CE 424/524, CE 427/527, CE 429/529, CE 442/542, CE 475/575, CE 485/585, CE 486/586, CE 570
Minor in Structural Engineering	• Required Courses (12 credit hours): CE 331, CE 432/532, CE 433, CE 434, • Electives (3 credit hours): CE 436/536, CE 437/537, CE 438/538, CE 439/539, CE 444/544, or CE 534
Minor in Transportation Engineering	• Required Courses (6 credit hours): CE 350, CE 458/558 • Electives (9 credit hours): CE 417/517, CE 418/518, CE 451/551, CE 452/552, CE 453/553, CE 454/554, CE 457/557, CE 459/559, CE 481/581, CE 573, GES 401/501, GES 585, GY 458, GY 465, GY 466, OM 517, and ME 461

Graduate School – Why You Should Consider an MS Degree

The engineering profession is one that offers you a dynamic and exciting future. What the public expects and society demands of tomorrow's engineers exceed what any program can reasonably fit into a four-year engineering degree. While great jobs are available to those graduating with a Bachelor of Science degree in engineering, many more opportunities open up to those who complement their Bachelor's degree with a Master of Science degree in engineering.

The National Academy of Engineering (NAE) clearly communicates the need for engineers to enhance their preparation to meet society's needs and challenges. In their report *Educating the Engineer of 2020*, the NAE states that the "exploding body of science and engineering knowledge cannot be accommodated within the context of a traditional four-year baccalaureate degree. The website raisethebarforengineering.org builds on NAE's observation and presents many arguments for why individual engineers should consider an advanced degree, and why the profession on the whole should "raise the bar" by requiring a masters degree or equivalent as a prerequisite to professional licensure.

You should consider, as part of your career preparation and planning, earning an MS degree in addition to your undergraduate degree. The University of Alabama offers both the Master of Science in Civil Engineering (MSCE) and the Master of Science in Environmental Engineering (MSEnvE). The MSCE and MSEnvE both require 30 credit hours of graduate study, which can be completed as quickly as one additional year. We also offer a unique joint MSCE/MBA degree program. For additional information on all the graduate degree options offered by the Department, please see a faculty member, come by the Department office, or visit the Department's graduate website (cce.eng.ua.edu/graduate).

To apply for admission to one of our programs, please visit the Graduate School website at graduate.ua.edu. If you have at least a 3.0 GPA, we guarantee admission into either the MSCE or MSEnvE program because we feel you have already proven your academic ability to successfully complete your MS degree. If you have a 3.3 or better GPA, we invite you to fast-track your MS degree by applying for and participating our University Scholars Program.

Seniors Taking Graduate Level Courses

Students with a minimum 3.0 GPA can get a taste of graduate school by taking a graduate level course, and there are several ways to do this, including actually getting a jump-start on a master's degree. If you have at least a 3.0 GPA, you are encouraged to consider taking graduate level courses as part of your undergraduate degree program as a senior elective. If you have extra room in your schedule, you may also consider taking a graduate level course and reserve the credit for a future master's degree; you cannot count such a course towards your BS degree. If you have a minimum GPA of 3.3 GPA, you are encouraged to consider participating in the University Scholars Program, which allows you to double count up to 9 credit hours towards both your BS and MS degree.

To request taking a graduate course, whether as part of the University Scholars Program, as a senior elective, or in addition to your BS degree requirements (and reserve the course credit for a future graduate degree), you must complete and submit the "Request for Undergraduate Students to Take Graduate Level Course" form (see Appendix C). The form requires approval of your undergraduate advisor, a graduate faculty member in the department, and the department's Director of Graduate Programs.

University Scholars Program – Get a Jump-Start on Graduate School

If you have at least a 3.3 GPA (overall) and 90 credit hours earned towards your bachelor's degree, you are invited to apply for and participate in the University Scholars Program. This program allows you to earn up to nine credit hours towards your Masters degree in tandem with completing your undergraduate degree. All you need to do is apply for our MSCE or MSEnvE program during your junior year. As noted above, you are guaranteed admission, so there is absolutely no risk. After you are formally admitted into the graduate program, you are then in the University Scholars Program and considered a "provisional" graduate student, provisional only because you have not completed your Bachelor's degree yet. During your senior year, you will take three electives at the 500- or 600-level. These three classes, or nine credit hours, will double count towards both your BS degree and your MS degree. Therefore, when you graduate with your BS degree, you will have nine hours already earned towards your MS degree, leaving you only 21 hours to earn your Masters. It is important to note that you must be admitted into the Graduate School prior to taking any graduate level courses that you intend to be included in the Scholars program and double counted towards both your BS and MS degrees.

To request permission to take the three graduate level CE courses as part of the University Scholars Program you must complete and submit the "Request for Undergraduate Students to Take Graduate Level Course" form (see Appendix C). The form requires approval of your undergraduate advisor, your graduate advisor or a graduate faculty member in your intended area of study, and the department's Director of Graduate Programs.

For additional information on the Scholars program, please see a faculty member, come by the Department office, or visit the Department's Scholar's website (cce.eng.ua.edu/undergraduate/scholars-program). To apply for graduate school and the University Scholars program, please visit the Graduate School website at graduate.ua.edu.

Pathway to Licensure – Don't Graduate Without Passing the FE

Professional licensure should be a consideration for every engineering student. The pathway to licensure is straightforward, and starts with becoming an Engineer Intern (EI). An EI is the legal term for any individual who has earned a Bachelor of Science degree in engineering from an ABET-accredited program and who has passed the Fundamentals of Engineering (FE) exam. As an EI, you will then serve under the mentorship of a licensed professional engineer (PE) and accumulate four years of qualified experience. If you continue your education at the master's level, your MS degree in engineering would count towards one year of experience as well. But, as an undergraduate, you do not want to limit any future opportunities so it is important for you to leave the University of Alabama with both your BSCE or BSConE and having passed the FE exam so you too can be designated an Engineer Intern (EI).

The National Council of Examiners for Engineering and Surveying (ncees.org) administers the FE exam. The FE is given via computer-based testing, and you will select the exam for which you feel most well prepared (ncees.org/exams/fe-exam/). We recommend for BSCivE, BSArchE, and BSConE students to take the civil exam and for BSEnvE students to take the environmental exam. Regardless, with appropriate preparation, including attending and participating in all review FE sessions, you should be ready to take and pass this important first step to professional licensure.

Our curricula are designed to prepare you for successful entry into the profession, and this includes preparing you to pass the FE. Both the civil and environmental engineering FE exams include 110 multiple-choice questions. For each exam, NCEES publishes the general topic areas, specific topics within each topic area, and number of questions in each general topic area. For additional information please visit ncees.org/exams/fe-exam/.

The National Society of Professional Engineers (NSPE) Offers Five Reasons to Get Licensed

1. **Prestige**: PEs are respected by the public and are seen in the same light as licensed professionals in other fields. PEs are also held in high esteem by their peers within the engineering community who see the PE as part of an elite group.
2. **Career Development**: Employers are impressed with engineers who have their PE license. Licensure not only enhances your stature, it shows commitment to the profession and demonstrates heightened leadership and management skills. Licensure is also a necessity for rising to increased levels of authority and responsibility.
3. **Authority**: Only PEs can sign and seal engineering drawings; and only PEs can be in responsible charge of a firm in private practice or serve as a fully qualified expert witness. Also, many government agencies and educational institutions are emphasizing licensure among their engineers as well.
4. **Flexibility**: Having a PE license opens up your career options. You can become a specialist, or establish your own business. It also protects you during industry downsizing or outsourcing. The PE license allows you to go as far as your initiative and talent will take you.
5. **Money**: Studies have shown that most PEs earn higher pay throughout their business careers. Having your PE allows expanded opportunities beyond a company structure - as an independent consultant for example.

Appendix A: Course Listing – What CE Courses Are Offered and When

As you work with your advisor and faculty mentor to plan your electives, you should consider both what you would like to take and when those courses are offered. Below is a listing of all CE-prefix courses currently offered by the department and when (tentatively) the courses will be taught. Included are 400-, 500-, and 600-level courses. If you have a 3.0 or higher overall GPA, you are encouraged to consider taking 500-level courses as part of your senior coursework. With a 3.3 or higher GPA you are encouraged to participate in the University Scholars (BS/MS) Program and to take 500- and/or 600-level electives (600-level courses can only be taken as part of the University Scholars Program).

Course No.		Course Title	Fall	Spring
CE 414	CE 514	Information Systems Design	Even Years	
CE 417	CE 517	Advanced Project Management	Annually	
CE 418	CE 518	Engineering Management		Annually
CE 420		Environmental Measurements		Annually
CE 422	CE 522	Solid and Hazardous Waste Management		Annually
CE 424	CE 524	Water and Wastewater Treatment	Annually	
CE 425	CE 525	Air Quality Engineering		Annually
CE 432	CE 532	Matrix Analysis of Structures		Annually
CE 433		Reinforced Concrete Structures I	Annually	
CE 434		Structural Steel Design I		Annually
CE 435	CE 535	Concrete Materials		Annually
CE 437	CE 537	Reinforced Concrete Structures II		Annually
CE 438	CE 538	Structural Steel Design II	Annually	
CE 439		Wood and Masonry Structures		Odd Years
CE 442	CE 542	Waste Containment Facilities	As Needed	
CE 444	CE 544	Foundation Engineering	As Needed	
CE 451		Geometric Design of Roadways	Annually	
CE 454	CE 554	Urban Transportation Planning	Annually	
CE 458		Traffic Engineering		Annually
CE 459	CE 559	Pavement Design and Rehabilitation		Odd Years
CE 461	CE 561	Horizontal Construction Methods	Annually	
CE 462	CE 562	Vertical Construction Methods		Annually
CE 463	CE 563	Construction Cost Estimating		Annually
CE 464	CE 564	Safety Engineering		Annually
CE 467	CE 567	Construction Accounting and Finance		Annually
CE 468	CE 568	Construction Scheduling	Annually	
CE 470		Water Resources in the European Alps	Summer (Study Abroad)	
CE 475	CE 575	Hydrology	Annually	
CE 480	CE 580	Forensic Engineering	Annually	
CE 481	CE 581	Legal Aspects of Engineering & Construction		Annually
CE 485	CE 585	Construction Site Erosion Control	Summer	
CE 486	CE 586	GIS for Civil Engineers	As Needed	
CE 491	CE 591	Special Problems	As Needed	
CE 498		Undergraduate Research Experience	Annually	Annually

The following courses may only be taken with permission by students with a 3.0 or higher overall GPA or by students in the University Scholars Program

Course No.	Course Title	Fall	Spring
CE 521	Environmental Engineering Microbiology	Annually	
CE 531	Structural Dynamics	Annually	
CE 533	Structural Loads	Annually	
CE 534	Advanced Structural Mechanics	Annually	
CE 536	Wood Structural Design	As Needed	
CE 541	Wind and Earthquake Engineering		Annually
CE 543	Prestressed Concrete Structures	As Needed	
CE 553	Intelligent Transportation Systems	As Needed	
CE 556	Transportation System Analysis	As Needed	
CE 560	Front End Planning	Annually	
CE 570	Open Channel Flow		Annually
CE 573	Statistical Applications		Annually

The following courses may only be taken with permission by students in the University Scholars Program

Course No.	Course Title	Fall	Spring
CE 616	Advanced Information Systems	Odd Years	
CE 624	Water Quality Engineering	Odd Years	
CE 626	Physical and Chemical Processes		Annually
CE 631	Experimental Structural Dynamics	As Needed	
CE 633	Structural Reliability		Even Years
CE 635	Analytical Methods in Cement and Concrete	As Needed	
CE 636	Advanced Infrastructure Materials		Even Years
CE 640	Earthquake Engineering	As Needed	
CE 641	Wind Engineering	As Needed	
CE 655	Sustainable Transportation	Even Years	
CE 656	Transportation Demand and Network Modeling	Odd Years	
CE 658	Traffic Flow Theory		Even Years
CE 671	Hydrologic Modeling	Annually	
CE 686	Advanced GIS	As Needed	
CE 691	Special Problems	As Needed	

Appendix B: Course Descriptions – What You Should Know About CE Courses

There are a number of things to consider when select your senior plan of study electives, including what areas of practice interest you, if you are adding a minor to complement your Bachelor's degree, and which senior design class you plan to take. As you work with your advisors to develop your plan of study you may need additional information about some of the courses available to you. To assist you, the faculty has developed short descriptions of each 400-level course offered by the Department. Included for each course are the catalog description for the course, the prerequisites and co-requisites for the course, a statement as to why you should consider taking this course, when (tentatively) the course will be taught, and how the course counts towards degree requirements.

400- and 500-Level CE-Prefix Senior Plan of Study Electives

Students with a 3.0 or higher overall GPA are encouraged to consider taking 500-level courses as part of their senior coursework. Students with a 3.3 or higher GPA are encouraged to participate in the University Scholars (BS/MS) Program.

CE 414/514	**Information Systems Design**
Catalog Description	An overview of Management Information Systems (MIS). The course will focus on the practical aspects, applications, and methodology of MIS, particularly from the civil and construction engineers' perspective. Information systems design methodology and building information modeling (BIM) will be covered in detail.
Prerequisites	CE366
Why should you take this course?	Computer-based systems are the tools of the modern engineer. This course will provide you with information regarding databases, common information systems used by civil and construction engineers, and the emerging area of BIM.
When is it taught?	Fall, even years
How does this course count towards degree?	BSCivE: Professional Practice (P) Elective BSConE: Project Management (PM) Elective BSArchE: N/A BSEnvE: N/A

CE 417/517	**Advanced Project Management**
Catalog Description	CE417/517 takes a comprehensive view of the total project, from the planning and organizational stages to the actual implementation. This course will describe organizational alternatives and detail the stages and processes of controlling scope, time and cost.
Prerequisites	CE366
Corequisites	GES 255 (may be taken with concurrent enrollment)
Why should you take this course	This course will provide you with an understanding of construction project planning and control principles, the relationships among time, cost, and resources in such projects, and experience with the activity on arrow method of scheduling. Practical examples and case studies will be used throughout to demonstrate the application of principles.
When is it taught?	Fall, annually
How this course count towards degree	BSCivE: Professional Practice (P) Elective BSConE: Project Management (PM) Elective BSArchE: N/A BSEnvE: N/A

CE 418/518	Engineering Management
Catalog Description	An introduction to management principles and the management functions of planning, organizing, motivation, and control. The management of research, design, manufacturing/construction, and quality will be studied.
Prerequisites	CE 366
Why should you take this course	Students who understand organization and management will find they have a much easier time transitioning in as an entry-level professional. You will understand why your managers do things the way they do, what their expectations of you and why.
When is it taught?	Spring, annually
How this course count towards degree	BSCivE: Professional Practice (P) Elective BSConE: Required BSArchE: N/A BSEnvE: N/A

CE 420	Environmental Measurements
Catalog Description	Environmental Engineering phenomena are explored through conducting laboratory experiments, selecting analytical protocols to achieve an objective, evaluating collected data sets, and discussing the results in well written reports. The course is composed of classroom lectures/discussions and weekly laboratory activities.
Prerequisites	CE 320 and CE 378
Why should you take this course	Understanding how data in natural and engineered systems are gathered, analyzed and interpreted is essential for civil and environmental engineers. This course will give you the opportunity to enhance your understanding of the major areas in environmental engineering through hands-on investigation. Lab topics include: surface water quality, drinking water treatment, wastewater treatment, environmental microbiology, air pollution, reactor dynamics, and soil leaching.
When is it taught?	Spring, annually
How this course count towards degree	BSCivE: General Technical (G) Elective BSConE: N/A BSArchE: N/A BSEnvE: Required

CE 422/522	Solid and Hazardous Waste
Catalog Description	Principles and regulatory requirements for the management, and disposal of solid and hazardous wastes
Prerequisites	CE320
Why should you take this course	You will be exposed to the practical tools necessary to manage and comply with regulations in the workplace regarding solid and hazardous waste including RCRA, CERCLA and EPCRA programs. Fundamental principles covered: Risk, Material Recovery, Composting, Compatibility, Landfilling (siting, design for protection of the environment, monitoring, energy recovery), Site characterization and remediation planning. Hazardous and radioactive waste treatment options.
When is it taught?	Spring, annually
How this course count towards degree	BSCivE: General Technical (G) Elective BSConE: N/A BSArchE: N/A BSEnvE: Required
CE 424/524	**Water and Wastewater Treatment**
Catalog Description	Design of municipal water and wastewater treatment units
Prerequisites	CE320
Why should you take this course	You will advance your understanding of the theory and design of traditional water and wastewater treatment processes including water and wastewater characteristics. Mass balances conventional water treatment processes (e.g., clarification, disinfection, filtration, flocculation, rapid mix), conventional wastewater treatment processes (e.g., activated sludge, decentralized wastewater systems, fixed-film system, disinfection, flow equalization, headworks, lagoons), and sludge treatment and handling (e.g., land application, sludge digestion, sludge dewatering)
When is it taught?	Fall, annually
How this course count towards degree	BSCivE: Design (D) Elective BSConE: N/A BSArchE: N/A BSEnvE: Required

CE 425/525	Air Quality Engineering
Catalog Description	Introduction to the sources, characteristics, and effects of air pollution and to air pollution control technology and design.
Prerequisites	CE 320 and AEM 311, or CHE 304
Why should you take this course	Air pollution is a major area of environmental engineering and often constrains design and activities in other civil engineering disciplines (transportation, construction, architectural, building systems, etc.). You were introduced to some of this in CE 320. This course will provide you with more information about designing control systems and approaches to air quality.
When is it taught?	Spring, annually
How this course count towards degree	BSCivE: Design (D) Elective BSConE: N/A BSArchE: N/A BSEnvE: Required

CE 432/532	Matrix Analysis of Structures
Catalog Description	Introduction to the matrix-displacement method of analysis for framed structures, including computer implementation of analysis. An introduction to finite-element analysis is also included.
Prerequisites	CE 331
Why should you take this course	The matrix-displacement method embodied in virtually all modern structural analysis programs is the workhorse for calculating structural response. In this class, you will formulate your own matrix analysis for simple structures and in the process learn the strengths and limitations of this important structural analysis tool.
When is it taught?	Spring, annually
How this course count towards degree	BSCivE: General Technical (G) Elective BSConE: General Technical (GT) Elective BSArchE: Senior Elective BSEnvE: N/A

CE 433	Reinforced Concrete Structures I
Catalog Description	Concrete materials, placement of concrete and theory and design of reinforced beams, girders, slabs, columns and footings.
Prerequisites	CE 331
Why should you take this course	Reinforced concrete is used to build everything from highways to water treatment plants to skyscrapers. And while many consider this ubiquitous building material to be “low tech”, the behavior of reinforced concrete is actually complex. In this course you will learn the basics of reinforced concrete behavior and design simple reinforced concrete components such as slabs, beams and columns.
When is it taught?	Fall, annually
How this course count towards degree	BSCivE: Design (D) Elective BSConE: Construction Design (CD) Elective BSArchE: Required BSEnvE: N/A

CE 434	Structural Steel Design I
Catalog Description	Theory and design of structural steel members and their connections.
Prerequisites	CE 331
Why should you take this course	Structural steel is a direct competitor with reinforced concrete for many construction projects. In this course, you will learn about the advantages of constructing with this versatile material as well as how to design steel columns, beams and other components.
When is it taught?	Spring, annually
How this course count towards degree	BSCivE: Design (D) Elective BSConE: Construction Design (CD) Elective BSArchE: Required BSEnvE: N/A

CE 435/535	Concrete Materials
Catalog Description	Portland cement and supplementary cementitious materials, aggregates, properties of fresh and hardened concrete, concrete durability issues, mixture proportioning, concrete construction methods, special concrete materials, test methods.
Prerequisites	CE 331 or CE 340
Why should you take this course	Knowledge of construction materials is essential to structural design, and concrete is the most widely used man-made material in the world. You will learn about how to produce more durable, and therefore, more sustainable concrete structures in this class. This knowledge will give you an advantage in the job market and make you a much more marketable asset to an engineering design or consulting firm.
When is it taught?	Spring, annually
How this course count towards degree	BSCivE: Design (D) Elective BSConE: Construction Design (CD) Elective BSArchE: N/A BSEnvE: N/A

CE 437/537	Reinforced Concrete Structures II
Catalog Description	Design of reinforced concrete building components including two-way slabs, slender columns, prestressed beams, slap-on-grade and retaining walls.
Prerequisites	CE 433
Why should you take this course	Building directly on the skills and knowledge acquired in CE 433 Reinforced Concrete Structures I, you will learn to design state-of-the-art building components such as post-tensioned flat-slab floor systems.
When is it taught?	Spring, annually
How this course count towards degree	BSCivE: Design (D) Elective BSConE: Construction Design (CD) Elective BSArchE: Senior Elective BSEnvE: N/A

CE 438/538	Structural Steel Design II
Catalog Description	Basic and elementary design procedures for steel structures such as plate girders, mill buildings, multistory buildings, highway bridges and light-gauge steel structures.
Prerequisites	CE 434
Why should you take this course	This second and final course in structural steel design will complete your steel design “tool box” with topics including composite floors, plate girders, bolted and welded connections, 2nd-order direct analysis method, and introduction to plastic analysis and design.
When is it taught?	Fall, annually
How this course count towards degree	BSCivE: Design (D) Elective BSConE: Construction Design (CD) Elective BSArchE: Senior Elective BSEnvE: N/A

CE 439	Wood and Masonry Structures
Catalog Description	Design of wood and masonry components and subassemblies for low-rise residential and commercial buildings according to current design specifications.
Prerequisites	CE 331
Why should you take this course	Students in this practical course will learn the basics for designing wood and masonry components for residential and low-rise commercial buildings. Upon completing this course you will be able to design a wide variety of common structural components including bearing and shear walls, floor joists, floor and roof diaphrams, rafters and roof trusses.
When is it taught?	Spring, odd years
How this course count towards degree	BSCivE: Design (D) Elective BSConE: Construction Design (CD) Elective BSArchE: Senior Elective BSEnvE: N/A

CE 442/542	Waste Containment Facilities
Catalog Description	Introduction to the fundamentals of soil behavior as they relate to environmental engineering. Topics include soil behavior, soil compaction, conduction phenomena, geosynthetics and aspects of landfill design.
Prerequisites	CE 320 and CE 340
Why should you take this course	Designing a landfill or waste containment facility requires a student to understand many fundamental aspects of geotechnical and environmental engineering including: slope stability, contaminant transport, settlement, pipeflow design, and the use of geosynthetics. This course produces a solid understanding of these and other topics that can be applied to many aspects of civil engineering.
When is it taught?	As needed
How this course count towards degree	BSCivE: Design (D) Elective BSConE: Construction Design (CD) Elective BSArchE: N/A BSEnvE: Senior Elective

CE 444/544	Foundation Engineering
Catalog Description	Analysis and design of soil foundation systems.
Prerequisites	CE 340
Why should you take this course	Most of the built environment sits upon a foundation. Understanding the geotechnical aspects of foundation engineering will allow students to design both shallow and deep foundations for different load scenarios. Choosing correct soil tests to produce a foundation design that maximizes soil strength while limiting settlement are key objectives that will be learned in this course.
When is it taught?	As Needed
How this course count towards degree	BSCivE: Design (D) Elective BSConE: Construction Design (CD) Elective BSArchE: Senior Elective BSEnvE: N/A

CE 451	Geometric Design of Roadways
Catalog Description	Application of the principles of geometric design: alignment, vertical control, drainage, traffic control, interchanges and intersections. Design projects will be prepared to illustrate standard techniques.
Prerequisites	CE 350
Why should you take this course	This course introduces you to the design skills essential to transportation engineering careers in both private and public sectors. You will learn the basics of road geometric design (both horizontal and vertical design alignment) as well as how to lay out the signal heads, supports, wiring, and control box of a traffic signal system.
When is it taught?	Fall, annually
How this course count towards degree	BSCivE: Design (D) Elective BSConE: N/A BSArchE: N/A BSEnvE: N/A

CE 454/554	Urban Transportation Planning
Catalog Description	The course will provide a foundation in urban transportation planning, including an introduction to the planning process, software associated with transportation modeling and conducting transportation planning and traffic impact studies.
Prerequisites	CE 350
Why should you take this course	Transportation planning and programming process involves forecasting travel demand and evaluating alternative systems, technologies, and services. This course will provide you a good understanding of the principles, concepts, data needs, and methodologies involved in transportation planning.
When is it taught?	Fall, annually
How this course count towards degree	BSCivE: General Technical (G) Elective BSConE: N/A BSArchE: N/A BSEnvE: N/A

CE 458	Traffic Engineering
Catalog Description	Vehicle operating characteristics, traffic flow, geometric design of road and intersections, and methods of traffic control.
Prerequisites	CE 350
Why should you take this course	Traffic engineering is an essential component of modern society. It affects the safety and efficiency of the movements of people and goods in, around and between cities and towns. Everything from crosswalks and other pedestrian facilities to busy urban streets and freeways must be engineered. This course provides you with the fundamental understanding and basic tool set for engineers to conduct operational analyses and design–related activities for freeways and highways, signalized and unsiganlized intersections, roundabouts.
When is it taught?	Spring, annually
How this course count towards degree	BSCivE: General Technical (G) Elective BSConE: N/A BSArchE: N/A BSEnvE: N/A

CE 459/559	Pavement Design and Rehabilitation
Catalog Description	This course combines initial pavement design (material selection and thickness calculation of concrete and asphalt pavements) with pavement maintenance activities (including overlay design thickness, distress surveys, pothole repair, and crack and joint sealing). New description – not yet approved.
Prerequisites	CE 350 or CE 366
Why should you take this course	Pavements and sidewalks are everywhere, and local agencies, state agencies, and private construction firms all build and maintain them. This course will introduce you to the materials that make up both concrete (rigid) and asphalt (flexible) pavements, the methods for deciding how thick pavements should be, and the methods for repairing and resurfacing them.
When is it taught?	Spring, odd years
How this course count towards degree	BSCivE: Design (D) Elective BSConE: Construction Design (CD) Elective BSArchE: N/A BSEnvE: N/A
CE 461/561	**Horizontal Construction Methods**
Catalog Description	Introduction to horizontal construction equipment and methods, design of horizontal construction systems and construction operation analysis and simulation.
Prerequisites	CE 366
Corequisites	CE 340 (may be taken with concurrent enrollment)
Why should you take this course	Many large projects are not built on a single site, but are constructed over long distances. Such projects include highways, tunnels, subways, and pipelines just to name a few. Horizontal projects tend to be equipment intensive and typically involve significant earthmoving operations. This course will familiarize students with how to plan and manage large horizontal construction projects.
When is it taught?	Fall, annually
How this course count towards degree	BSCivE: Design (D) Elective BSConE: Required BSArchE: N/A BSEnvE: N/A

CE 462/562	Vertical Construction Methods
Catalog Description	Construction of buildings, including mechanical, electrical, plumbing and control systems, design of temporary structures, and planning and design of lifts.
Prerequisites	CE 366
Corequisites	CE 331 (may be taken with concurrent enrollment)
Why should you take this course	We all live in buildings and understanding how buildings are built will benefit you whether your professional interest is in the design or the construction of buildings. This course will introduce you to the many components, systems, and methods used to construct buildings and other similar structures.
When is it taught?	Spring, annually
How this course count towards degree	BSCivE: Design (D) Elective BSConE: Required BSArchE: Required BSEnvE: N/A

CE 463/563	Construction Cost Estimating
Catalog Description	Addresses the estimating and cost control function from conceptual planning through project execution. Topics include productivity analysis, organization of estimates, cost forecasting, estimating tools and techniques, contingency planning, and relationship to contract types and project execution strategies.
Prerequisites	CE 366
Why should you take this course	Engineering professionals must understand the importance of estimating and managing the costs associated with a project. This course will help you understand how to apply tools and techniques for construction cost estimating for different contract and project types. Cost estimates are the basis for important decision during project planning, design and construction.
When is it taught?	Spring, annually
How this course count towards degree	BSCivE: Professional Practice (P) Elective BSConE: Required BSArchE: Senior Elective BSEnvE: N/A
CE 464/564	**Safety Engineering**
Catalog Description	An introduction to safety management and accident prevention using state and federal laws related to general and construction projects.
Prerequisites	CE 366 and GES 255
Why should you take this course	All engineers have an ethical obligation to protect the public, fellow workers, facilities, and equipment from harm. Any engineer needs to understand the broad array of hazards, the physical and chemical laws behind them, the controls available, and how to implement these controls in facilities and work processes they design.
When is it taught?	Spring, annually
How this course count towards degree	BSCivE: General Technical (G) Elective BSConE: Required BSArchE: N/A BSEnvE: N/A

CE 467/567	Construction Accounting and Finance
Catalog Description	Applications of accounting and financial practice to management of construction projects.
Prerequisites	CE 366
Why should you take this course	This course will provide you with an overview of financial and accounting techniques utilized by practicing engineers in the construction industry. These include annual cost, present worth, rate of return, depreciation, and benefit cost methods of determining differences among design alternatives. The impact of taxes on decision-making, and equipment replacement will also be covered.
When is it taught?	Spring, annually
How this course count towards degree	BSCivE: Professional Practice (P) Elective BSConE: Project Management (PM) Elective BSArchE: Senior Elective BSEnvE: N/A

CE 468/568	**Construction Scheduling**
Catalog Description	The management structure of construction companies and the laws, regulations, practices, tools, and processes used in planning, scheduling, and monitoring construction projects. Writing proficiency is required for a passing grade in this course.
Prerequisites	CE 366
Why should you take this course	It is important for engineers to learn how projects are organized, scheduled, and controlled to ensure on time completion. This course addresses how to document planned work using logical network analysis techniques and you will learn how to evaluate progress during project execution.
When is it taught?	Fall, annually
How this course count towards degree	BSCivE: Professional Practice (P) Elective BSConE: Required BSArchE: Senior Elective BSEnvE: N/A

CE 470	**Water Resources in the European Alps** (Study Abroad)
Catalog Description	The course focuses on statistical hydrology, climate, dendrohydrology (tree rings) and glaciers. The classroom lectures and in-class labs include the use of statistical software to analyze hydrologic datasets, the use of remote imagery to evaluate glacier recession, application of empirical equations to estimate glacier mass loss, evaluation of hydrologic (streamflow, snowpack) and climatic datasets, developing skeleton plots and cross dating tree-ring data, and seminars. The field labs consist of hand coring and analyzing tree ring data.
Prerequisites	CE 378
Why should you take this course	For students interested in water resources, climate and climate change. This course offers a unique opportunity to understand how tree ring datasets are used in hydrology.
When is it taught?	Summer (study abroad)
How this course count towards degree	BSCivE: General Technical (G) Elective BSConE: N/A BSArchE: N/A BSEnvE: Senior Elective

CE 475/575	**Hydrology**
Catalog Description	Hydrologic cycle, rainfall-runoff relations, unit hydrograph, statistical hydrology and hydrologic simulation. Includes a class project with application to flood control, water supply and multipurpose projects.
Prerequisites	CE 378
Why should you take this course	This is a fundamental course for any student pursuing a specialization in water resources engineering. It should also be taken by any student with an interest in design of stormwater control facilities.
When is it taught?	Fall, annually
How this course count towards degree	BSCivE: Design (D) Elective BSConE: N/A BSArchE: N/A BSEnvE: Senior Elective

CE 480/580	Forensic Engineering
Catalog Description	When failures in the built environment occur, whether during design, construction or in-service, a thorough examination of the causes is essential to both the evolution sound engineering practices and to dispute resolution through the legal system. The role of the engineer in this process is examined.
Prerequisites	AEM 250 and any 300-level CE course
Why should you take this course	If you plan to practice engineering, here is an opportunity to learn from the mistakes of others before they happen to you, and how to effectively determine the cause of a failure.
When is it taught?	As Needed
How this course count towards degree	BSCivE: Design (D) Elective BSConE: N/A BSArchE: N/A BSEnvE: Senior Elective

CE 481/581	Legal Aspects of Engineering and Construction
Catalog Description	Legal aspects of engineering and construction contracts and specifications; contract formation, interpretation, rights and duties, and changes; legal liabilities and professional ethics of architects, engineers and contractors.
Prerequisites	Any 300-level CE course (3 credits) and any HU/L/FA (3 credits)
Why should you take this course	Engineering is both a profession and a business. As a profession, it is regulated by the State and subject to ethical considerations. As a business, the exchange of legal obligations are based on contracts. An understanding of elementary contractual concepts is important. Construction and engineering, by their nature, involve danger to life and limb. It is important for the engineer to anticipate areas of potential liability and manage those risks, both by an awareness of the ramifications of their conduct and by taking steps to insure against the same. This course is recommended to those students who expect to work with or manage engineering or construction firms.
When is it taught?	Spring, annually
How this course count towards degree	BSCivE: Professional Practice (P) Elective BSConE: Project Management (PM) Elective BSArchE: Senior Elective BSEnvE: Senior Elective

CE 485/585	Construction Site Erosion Control
Catalog Description	Nature and magnitude of erosion problems. Erosion plan development. Rainfall energy and erosion predictions. Sediment transport in urban areas. Channel and slope stability. Sedimentation and other controls.
Prerequisites	CE 378
Why should you take this course	This course is intended for students, practicing engineers, and others, who are concerned with the management of construction site erosion.
When is it taught?	Summer
How this course count towards degree	BSCivE: Design (D) Elective BSConE: Construction Design (CD) Elective BSArchE: N/A BSEnvE: Senior Elective

CE 486/586	**GIS for Civil Engineers**
Catalog Description	Introduction to geographic information system design and use for civil engineering problem solving.
Prerequisites	CE 260 and any 300-level CE course
Why should you take this course	Geographic Information System (GIS) technology has moved from a primary goal of making maps to the more advanced goal of performing complex spatial analysis. Many civil engineering firms have realized this and are seeking engineers that possess a GIS skill set. This course provides a student with a fundamental understanding of GIS capabilities that will allow them to design and use GIS applications related to civil engineering.
When is it taught?	Spring, even years
How this course count towards degree	BSCivE: General Technical (G) Elective BSConE: N/A BSArchE: N/A BSEnvE: Senior Elective

CE 491/591	**Special Problems** (variable credit)
Catalog Description	Credit is based on the amount of work undertaken. Analysis and/or design in any phase of civil engineering. The course is intended to take care of needs not covered by regularly offered courses.
Prerequisites	Any 300-level CE course and permission of instructor
Why should you take this course	Faculty may offer courses not listed in the catalog or may work with students on special projects for course credit.
When is it taught?	As needed
How this course count towards degree	BSCivE: General Technical (G) Elective unless otherwise approved BSConE: General Technical (GT) Elective unless otherwise approved BSArchE: Senior Elective with permission BSEnvE: Senior Elective with permission

CE 498	**Undergraduate Research Experience**
Catalog Description	Conduct research under the guidance of a faculty member. Analyze data. Produce and present, submit or publish related scholarly work.
Prerequisites	Any 300-level CE course and permission of instructor (research advisor)
Why should you take this course	If you are involved in undergraduate research you may take this course with the permission of your research advisor. The course grade will be based on participation in the research effort and the resulting research publications or presentations, which will be graded by your research advisor.
When is it taught?	As needed
How this course count towards degree	BSCivE: General Technical (G) Elective BSConE: General Technical (GT) Elective with permission BSArchE: Senior Elective with permission BSEnvE: Senior Elective with permission

CE 521	Environmental Engineering Microbiology
Catalog Description	Fundamentals of microbiology for environmental engineers and application of these principles to natural and engineered systems.
Prerequisites	CE 320
Why should you take this course	Microorganisms play an important role in environmental engineering and a basic knowledge of these living things is essential to understanding many natural and engineered systems. This course will address the fundamentals of microbial metabolism and behavior in the environment; this fundamental knowledge will support discussion of microorganisms as a threat (e.g., waterborne pathogens) and as a tool (e.g., in wastewater treatment) in environmental engineering. No previous background in microbiology is required to take this course.
When is it taught?	Fall, annually
How this course count towards degree	BSCivE: General Technical (G) Elective BSConE: N/A BSArchE: N/A BSEnvE: Senior Elective

CE 531	Structural Dynamics
Catalog Description	Response of civil engineering structures to typical dynamic loads including theory, development of basic equations, and measurement of structure response in the laboratory.
Prerequisites	CE 331
Why should you take this course	Wind and seismic loads excite structures dynamically. In this course, you will develop the equations used to predict the dynamic response of structures. And in the hands-on laboratory portion of the course, you will observe and measure the dynamic response of model structures in the Large Scale Structures Lab.
When is it taught?	Fall, annually
How this course count towards degree	BSCivE: General Technical (G) Elective BSConE: N/A BSArchE: Senior Elective BSEnvE: N/A

CE 533	Structural Loads
Catalog Description	Calculation of typical gravity and lateral loads on Civil Engineering structures, identification of load paths for different building systems, and preliminary evaluation of structural adequacy.
Prerequisites	CE 331
Why should you take this course	While courses in steel, reinforced concrete, wood and masonry design typically focus on component design (columns, beams, walls, etc.), this course focuses on the entire structure. Students will learn to calculate structural loads specified in building codes, to follow gravity and lateral loads through the structure, and to evaluate structural adequacy for select cases.
When is it taught?	Fall, annually
How this course count towards degree	BSCivE: General Technical (G) Elective BSConE: General Technical (GT) Elective BSArchE: Senior Elective BSEnvE: N/A

CE 534	Advanced Structural Mechanics
Catalog Description	Introduction to advances structural mechanics topics, including elementary elasticity, elementary beam theories, beams on elastic foundations, energy methods, buckling and free vibration of beams, and elementary thin-plate theory.
Prerequisites	CE 331
Why should you take this course	This course provides students with the analytical tools to examine a wide variety of structural responses. Such analytical solutions can be used to calibrate finite-element models, establish bounds on real-world problems, and study the sensitivity of a particular response to design parameters.
When is it taught?	Fall, annually
How this course count towards degree	BSCivE: General Technical (G) Elective BSConE: N/A BSArchE: N/A BSEnvE: N/A

CE 536	Wood Structural Design
Catalog Description	Modern timber engineering; design of beams, columns, trusses and floor systems.
Prerequisites	CE 331
Why should you take this course	There are more buildings constructed of wood than any other structural material. The widespread use of wood in construction of buildings has both economic and aesthetic advantages. In this course, you will be introduced to the subject of structural wood materials and design as applied to wood-frame building construction. This course is recommended to those students interested in careers involving structural design or building construction.
When is it taught?	As needed
How this course count towards degree	BSCivE: Design (D) Elective BSConE: Construction Design (CD) Elective BSArchE: Senior Elective BSEnvE: N/A

CE 541	Wind and Earthquake Engineering
Catalog Description	Response of structures to extreme winds and earthquakes.
Prerequisites	CE 531
Why should you take this course	This course provides background to procedures for calculating code-specified wind and seismic loads, and goes beyond. Students will learn to calculate a design wind speed for a local region based on wind speed measurements, to interpret data from a wind tunnel test, and to predict structural response to vortex shedding. Students will also learn to perform a time-history analysis for earthquake loading (linear and non-linear), to construct a response spectrum, and design for earthquake loads using a performance-based design procedure.
When is it taught?	Spring, annually
How this course count towards degree	BSCivE: General Technical (G) Elective BSConE: N/A BSArchE: Senior Elective BSEnvE: N/A

CE 543	Prestressed Concrete Structures
Catalog Description	Analysis and design of prestressed concrete members, review of hardware, stress calculations, prestress losses, section proportioning, flexural design, shear design, deflections, and statically indeterminate structures.
Prerequisites	CE 433
Why should you take this course	Prestressed reinforced concrete components can be assembled rapidly at the construction site with associated cost savings. Prestressing also takes advantage of concrete's much higher compressive strength (compared to tensile strength) leading to improved structural efficiency. In this course, students will learn all aspects of prestressed concrete design including service-load behavior, flexure strength and shear strength.
When is it taught?	As needed
How this course count towards degree	BSCivE: Design (D) Elective BSConE: Construction Design (CD) Elective BSArchE: Senior Elective BSEnvE: N/A

CE 553	Intelligent Transportation Systems
Catalog Description	Introduction to intelligent transportation systems including traffic management, institutional and planning issues; system architecture, and system design/construction/operation.
Prerequisites	CE 350
Why should you take this course	Intelligent Transportation Systems (ITS) use new technology to reduce congestion and increase safety. Police, firefighters, and ambulance personnel can preempt traffic signals to get quickly to a crash scene, fire, or hospital. Variable message signs can tell drivers to take alternative routes to avoid congestion. Autonomous cars may soon take over the driving function to reduce traffic collisions and congestion due to the decreased need for safety gaps between cars.
When is it taught?	As needed
How this course count towards degree	BSCivE: General Technical (G) Elective BSConE: N/A BSArchE: N/A BSEnvE: N/A

CE 556	Transportation Systems Analysis
Catalog Description	Integration of systems analysis concepts and tools, including microeconomics, optimization, project evaluation and decision making, with application to transportation planning and management.
Prerequisites	CE 350
Why should you take this course	Transportation infrastructure is the fabric of a city. With the strong interactions between transportation and the rest of society, it is important to consider all elements and stakeholders of the transportation systems in a region as an integrated whole. In this course you will develop a "systems perspective" necessary for planning and management of transportation systems, and explore a set of quantitative tools for transportation analysts and decision-makers.
When is it taught?	As needed
How this course count towards degree	BSCivE: General Technical (G) Elective BSConE: N/A BSArchE: N/A BSEnvE: N/A

CE 560	Front End Planning
Catalog Description	Principles and applications for effective early planning of capital facilities including: finance, economics decision-making, risk management, team alignment, and front end planning processes and tools.
Prerequisites	CE 366
Why should you take this course	If you have ever wondered how major projects are actually planned and constructed, then this course is for you. This course presents industry best practices that define the various roles and responsibilities of an engineer as a project progresses in its' life-cycle from the feasibility phase into occupancy or operations.
When is it taught?	Fall, annually
How this course count towards degree	BSCivE: Professional Practice (P) Elective BSConE: Project Management (PM) Elective BSArchE: N/A BSEnvE: N/A

CE 570	Open Channel Flow
Catalog Description	Basic concepts of fluid flow, energy and momentum principles, flow resistance in nonuniform sections, channel controls and transitions, and nonuniform flow computations.
Prerequisites	CE 378
Why should you take this course	This is a fundamental course for any student pursuing a specialization in water resources engineering. It should also be taken by any student with an interest in the hydraulics of natural and man-made waterways.
When is it taught?	Spring, annually
How this course count towards degree	BSCivE: General Technical (G) Elective BSConE: N/A BSArchE: N/A BSEnvE: Senior Elective

CE 573	Statistical Applications in Civil Engineering
Catalog Description	Applications of statistical and probabilistic methodologies for analysis and solution of practical civil engineering problems, including frequency and risk analysis, analyses of experimental data, and systems simulation and optimization.
Prerequisites	MATH 238
Why should you take this course	This is the only course required for all graduate students in pursuing a degree offered by the department, regardless of their specific degree program. This is because engineering requires a firm understanding of and the ability to accurately characterize the risks and uncertainties that are naturally inherent in engineering analysis and design.
When is it taught?	Spring, annually
How this course count towards degree	BSCivE: General Technical (G) Elective BSConE: General Technical (GT) Elective BSArchE: Senior Elective BSEnvE: Senior Elective

600-Level CE-Prefix Electives (Available to University Scholars Students Only)

CE 616	Advanced Information Systems Design
Catalog Description	Current concepts regarding the design and development of decision support systems and expert systems, as well as their use by industry. The course includes case studies, problems and applications via term project.
Prerequisites	CE 414 or CE 514
Why should you take this course	Computer-based systems are the tools of the modern engineer. This course will provide you with information regarding the development of decision support systems and expert systems used by civil and construction engineers. Application to graduate-level research projects will also be discussed.
When is it taught?	Fall, odd years
How this course count towards degree	BSCivE: Professional Practice (P) Elective BSConE: Project Management (PM) Elective BSArchE: N/A BSEnvE: N/A

CE 624	Water Quality Modeling
Catalog Description	This course will involve detailed study of the the factors and processes the affect the physical, chemical and biological quality of water in streams, lakes and reservoirs. These processes will be described using mathematical formulations for simulation and prediction to support environmental management decisions.
Prerequisites	CE 424 or CE 524, GES 255 and MATH 238
Why should you take this course	In this course you will learn how to develop mathematical models to simulate the transport and fate of constituents in both natural and engineered water systems and use models to design and optimize treatment and remediation works.
When is it taught?	Fall, odd years
How this course count towards degree	BSCivE: General Technical (G) Elective BSConE: N/A BSArchE: N/A BSEnvE: Senior Elective

CE 626	Physical and Chemical Processes
Catalog Description	Physical and chemical and advanced treatment unit processes. This course will cover basic physical and chemical concepts, reactor kinetics, water qualities and quantities, and physical and chemical unit processes. Design of individual unit processes and integration of unit processes into treatment trains capable of meeting treatment objectives will be emphasized.
Prerequisites	CE 320 and CE 378
Why should you take this course	Being able to represent physical and chemical processes as mathematical formulations is fundamental to furthering our understanding of the environment. In this course, you will develop an understanding of the theory behind these processes, and translate the theory into mathematical models that can be used to model, optimize or design both engineered and natural environmental systems
When is it taught?	Spring, annually
How this course count towards degree	BSCivE: General Technical (G) Elective BSConE: N/A BSArchE: N/A BSEnvE: Senior Elective

CE 631	Experimental Structural Dynamics
Catalog Description	Introduction to experimental methods in the behavior of structures subjected to dynamic loading. Principles of vibration testing and digital signal processing. Current techniques in modal analysis, system identification, actuator and structural control, structural health monitoring.
Prerequisites	CE 531
Why should you take this course	With the knowledge from this course, you can apply modal analysis and signal processing to interpret experimental data obtained via dynamic testing, and investigate structural dynamic behavior using system identification techniques. In class, specific examples on structural control design for vibration reduction will also be provided.
When is it taught?	As needed
How this course count towards degree	BSCivE: General Technical (G) Elective BSConE: N/A BSArchE: Senior Elective BSEnvE: N/A

CE 633	Structural Reliability
Catalog Description	Fundamentals of structural reliability theory, risk analysis, and development of reliability-based design criteria
Prerequisites	CE 573 (may be taken concurrently)
Why should you take this course	Structural analysis and design is full of uncertainties, included both loads and resistances. This course provides you with an understanding and the tools to quantify the safety and reliability of structures.
When is it taught?	Spring, even years
How this course count towards degree	BSCivE: General Technical (G) Elective BSConE: General Technical (GT) Elective BSArchE: N/A BSEnvE: N/A

CE 635	Analytical Methods in Cement and Concrete
Catalog Description	Experimental methods used to characterize cementitious materials and conduct forensic or in-service investigations of concrete structures in the field (i.e. SEM, EDS, XRD, XRF, electron microprobe, calorimetry, and nondestructive testing / data acquisition & processing). Capabilities and limitations of these methods. Topics to rotate as needed to support current research.
Prerequisites	CE 435 or CE 535, or equivalent
Why should you take this course	You will learn about lab and field evaluation tools for concrete, many of which are commonly used by both researchers and consulting structural/materials engineers.
When is it taught?	As needed.
How this course count towards degree	BSCivE: General Technical (G) Elective BSConE: General Technical (GT) Elective BSArchE: N/A BSEnvE: N/A

CE 635	Advanced Infrastructure Materials
Catalog Description	Introduction to advanced and innovative materials used in civil infrastructure systems. An introduction to research methodology in materials is also included.
Prerequisites	CE 331
Why should you take this course	Advanced infrastructure materials are under fast development. You will learn how to repair/retrofit civil structures using fiber reinforced polymer composites, and how to monitor the health of structures using smart materials. You will also be exposure to the latest developments in materials such as self-sensing, self-healing materials, nanotechnology in materials, and green construction materials.
When is it taught?	Spring, even years
How this course count towards degree	BSCivE: General Technical (G) Elective BSConE: General Technical (GT) Elective BSArchE: N/A BSEnvE: N/A

CE 640	Earthquake Engineering
Catalog Description	Topics include engineering seismology, ground motion characterization, probabilistic hazard analysis, response spectra, inelastic structural analysis and performance-based earthquake-resistant design. The course will also introduce the recent development in the use of supplemental damping and seismic isolation systems to improve the seismic performance of buildings and bridges.
Prerequisites	CE 531
Why should you take this course	Seismic actions govern many designs for structures of all types. A thorough understanding of seismic actions and their effects on structures is important to today's structural engineer.
When is it taught?	As Needed
How this course count towards degree	BSCivE: General Technical (G) Elective BSConE: N/A BSArchE: Senior Elective BSEnvE: N/A

CE 641	Wind Engineering
Catalog Description	This research-oriented class is motivated by the need to provide a rational description of the phenomena involved and to develop appropriate analytical and design tools for structural engineering. The course attempts to present a synthesis of the main trends of specialized literature in Wind Engineering.
Prerequisites	CE 331
Why should you take this course	Wind forces, including straight-line, hurricane, and tornado, govern many designs for structures of all types. A thorough understanding of wind loading and their effects on structures is important to today's structural engineer.
When is it taught?	As needed
How this course count towards degree	BSCivE: General Technical (G) Elective BSConE: N/A BSArchE: Senior Elective BSEnvE: N/A

CE 671	Hydrologic Modeling
Catalog Description	Basics of surface water modeling including hydrologic modeling of watersheds / basins and flood routing.
Prerequisites	CE 378
Why should you take this course	The objective of the course is to provide you with exposure to several surface water models, including the U.S. Army Corps of Engineers (USACOE) Hydrologic Engineering Center (HEC) Hydrologic Modeling System (HMS) model and the USACOE HEC River Analysis System (RAS) model. Hands-on use of the models will be emphasized.
When is it taught?	Fall, annually
How this course count towards degree	BSCivE: General Technical (G) Elective BSConE: N/A BSArchE: N/A BSEnvE: Senior Elective

CE 686	Advanced GIS
Catalog Description	This graduate level project based course will investigate and apply advanced geographic information system (GIS) tools and programming techniques to solve complex spatially-related research problems. This course is intended for graduate students who want to develop, program, and customize GIS to meet specific civil engineering application requirements
Prerequisites	CE 486 or CE 586, or equivalent
Why should you take this course	This advanced project-based GIS course focuses on independent learning to program GIS applications that solve complex civil engineering problems that are worthy of conference or journal quality publication. GIS, research, writing, and publishing skills learned in this course are applicable across all areas of civil engineering and will benefit multiple aspects of a student's graduate studies.
When is it taught?	As Needed
How this course count towards degree	BSCivE: General Technical (G) Elective BSConE: N/A BSArchE: N/A BSEnvE: Senior Elective

Appendix C: Request for Undergraduate Students to Take Graduate Level Courses

The following form is used for undergraduate students to request to take graduate level courses for either:

1) University Scholars Program Courses to count towards both undergraduate and graduate degree, or
2) To take graduate level courses to either count towards their BS or towards a future masters degree.

For additional information and requirements, please see the University of Alabama Graduate Catalog.

Request for Undergraduate Students to Take Graduate Level Courses

University Scholars Dual (BS/MS) Credit ◆ Seniors Taking a Graduate Course

Civil Engineering ◆ Construction Engineering ◆ Architectural Engineering ◆ Environmental Engineering

Student's Name: _____

E-Mail Address: _____ CWID: _____

Student's Undergraduate Degree: ☐BSCivE ☐BSConE ☐BSArchE ☐BSEnvE

Student's Masters Degree (University Scholars Program Only): ☐MSCivE ☐MSEnvE

This form is used for undergraduate students to request to take graduate level courses for either:

1) University Scholars Program courses to count for both undergraduate and graduate degree, or
2) To take graduate level courses to either count towards their BS or towards a future graduate degree.

For additional information and requirements, please see the University of Alabama Graduate Catalog.

1) University Scholars Students Requesting Dual BS/MS Credit (9 credit hours maximum):

a) A minimum 3.3 GPA and completion of 91credit hours of undergraduate coursework is required.
b) You must submit your application for admission and be admitted to the University Scholars Program by the Graduate School before taking graduate level courses for dual credit.
c) Meet with your undergraduate and graduate advisors to assure graduate courses satisfy both BS and MS degree requirements.
d) University Scholars Students may be allowed to take 600-level courses.
e) Complete this form and obtain both your undergraduate and graduate advisors' approval.
f) Submit your completed form to the Department Graduate Program Assistant for department approval. Once approved, the form will be submitted to the Graduate School for approval.

Course Prefix & Number	Section	CRN	Course Title	Term

2) Seniors Requesting to Take a Graduate Course:

a) A minimum 3.0 GPA and completion of 91 credit hours of undergraduate coursework is required.
b) Meet with your undergraduate advisor and faculty mentor to determine appropriate graduate course(s) to **either** count toward the BS degree **or** count toward a future graduate degree.
c) Complete this form and obtain both your undergraduate advisor's and faculty mentor's approval.
d) Submit your completed form to the Department Graduate Program Assistant for department approval. Once approved, the form will be submitted to the Graduate School for approval.
e) Once the Graduate School approves the request, an override will be placed in the system to allow registration in the course(s) through myBama.

Course Prefix & Number	Section	CRN	Course Title	Term	Undergraduate or Graduate Designation*
					☐UG ☐GRAD
					☐UG ☐GRAD

*Seniors requesting to take a graduate level course as part of their BS degree should check UG
Seniors requesting to reserve a course to count towards a future graduate degree should check GRAD

Approvals:

Undergraduate Advisor: _____ Date: _____

Faculty Mentor or Graduate Advisor: _____ Date: _____

Graduate Director: _____ Date: _____

Rev: August 7, 2014