

Civil, Coastal, And Environmental Engineering

Department Information

Department of Civil, Coastal, and Environmental Engineering Staff	(251) 460-6174
Interim Chair	John Cleary
Professors	White, Webb
Associate Professors	Islam, Steward, Cleary, Kang
Assistant Professors	Macdonald, Smallegan, Wu

Department of Civil, Coastal, and Environmental Engineering website
<https://www.southalabama.edu/colleges/engineering/ce/index.html>

Civil Engineering involves the design and construction of systems necessary for our modern society to function. It encompasses many technical specialties whose focus is the design of large, normally one-of-a-kind, facilities such as bridges, buildings, tunnels, highways, dams, waterways, airports, flood control systems, coastal protection systems, water supply networks, and waste treatment plants. As our society expands, challenging opportunities will continue to be available for Civil Engineers practicing in their own private firms, in large companies, or in governmental agencies.

BSCE Program Educational Objectives:

The educational objectives of the Civil Engineering undergraduate program are that, within a few years of program completion, graduates will have used the knowledge and skills gain through academic preparation and post-graduation experience so they have:

1. Advanced in the civil engineering profession, obtained professional licensure, and applied engineering knowledge and problem-solving skills to multi-disciplinary projects.
2. Incorporated economic, environmental, social, regulatory, constructability, and sustainability considerations into the practice of civil engineering.
3. Exhibited effective communication, teamwork, leadership, initiative, project management, and professional and ethical behavior as complements to technical competence.
4. Continued their technical and professional development, which may include graduate level education, continuing education, and participation in professional organizations.

BSCE Student Outcomes:

By the time of graduation from the BSCE Program, students should attain the following outcomes:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

The Bachelor of Science in Civil Engineering program is accredited by the Engineering Accreditation Commission of ABET, <https://www.abet.org>.

The curriculum builds on a strong base in mathematics, physical sciences, engineering sciences, and humanities developed primarily during the freshman and sophomore years. During the junior year, students develop an understanding of the fundamentals of each area of Civil Engineering. The specialty areas include:

- Environmental Engineering
- Geotechnical Engineering
- Structural Engineering
- Transportation Engineering
- Water Resources/Coastal Engineering

The senior year focuses on design, construction practices, and the integration of more advanced knowledge in civil engineering. A comprehensive project with students participating in a design team prepares them to enter professional practice.

Satisfactory completion of the program outlined in this Bulletin leads to a degree of Bachelor of Science in Civil Engineering. Students must also comply with the College of Engineering Requirements for a Degree which is covered in this Bulletin under College of Engineering.

BSCE Accelerated Bachelor's To Master's (ABM) Degree Option

The Department of Civil, Coastal, & Environmental Engineering allows well-qualified undergraduates in the program to follow an "Accelerated Bachelor's to Master's" study plan. This plan permits up to six credit hours of graduate coursework to count towards both the Bachelor's (as Technical Electives) and the Master's degrees, so that the Master's degree is earned faster than usual. (The coursework concerned must individually satisfy the requirements of both degrees.) See a departmental advisor for specific details.

Areas Of Study

Civil Engineering (BS)
 Civil Engineering (MS)
 Civil Engineering - Coastal Engineering Certificate
 Civil Engineering - Structural Engineering Certificate
 Civil Engineering - Water/Wastewater Engineering Certificate

Courses

Civil Engineering (CE) (CE)

CE 102 Intro to Civil Engineering 2 cr

Introduction to Civil Engineering as a profession and the issues facing today's Civil Engineers. This course also includes a brief introduction of civil engineering sub-disciplines, freehand sketching techniques, Computer Aided Design (CAD) drawings, and spreadsheet application to civil engineering problems.

Pre-requisite: MA 113 Minimum Grade of D or MA 125 Minimum Grade of D.

CE 204 Surveying Fundamentals 2 cr

Applications of fundamental surveying techniques. Students will be introduced to the applications of Global Positioning Systems (GPS) and Geographical Information Systems (GIS) in Civil Engineering.

Co-requisite: CE 205

Pre-requisite: MA 113 Minimum Grade of C or MA 115 Minimum Grade of C or MA 125 Minimum Grade of C and CE 102 Minimum Grade of C. MA 125 can be taken concurrently with this course.

- CE 205 Surveying Fundamentals Lab** 1 cr
Students will collect field data and using state-of-the-art surveying and GPS equipment. Collected data will be used in Geographical Information Systems (GIS) software.
Co-requisite: CE 204
Pre-requisite: MA 113 Minimum Grade of C or MA 115 Minimum Grade of C or MA 125 Minimum Grade of C and CE 102 Minimum Grade of C. MA 125 can be taken concurrently with this course.
- CE 314 CE Materials** 3 cr
Study of Engineering Properties of Materials used in civil engineering including steel, concrete, asphalt, and timber.
Co-requisite: CE 315
Pre-requisite: EG 315 Minimum Grade of D.
- CE 315 CE Materials Lab** 1 cr
Study of experimental techniques used to evaluate engineering properties of materials. These techniques will be used to test materials used in civil engineering according to ASTM standards.
Co-requisite: CE 314
Pre-requisite: EH 102 Minimum Grade of C or EH 105 Minimum Grade of C and EG 315 Minimum Grade of D.
- CE 340 Soil Mechanics** 3 cr
An introduction to Soil Mechanics. Soil identification and engineering properties of soils. Analysis of elementary geo-hydraulics and geo-mechanics problems.
Co-requisite: CE 341
Pre-requisite: EG 315 Minimum Grade of D and (EG 360 Minimum Grade of D or CE 365 Minimum Grade of D or ME 324 Minimum Grade of D).
- CE 341 Geotechnical Laboratory-W** 1 cr
Soil identification and classification: experimental measurement of soil properties and technical reporting.
Co-requisite: CE 340
Pre-requisite: (EH 102 Minimum Grade of C or EH 105 Minimum Grade of C) and CE 340 Minimum Grade of D. CE 340 can be taken concurrently with this course.
- CE 352 Intro to Transportation** 3 cr
Principles of transportation engineering with emphasis on highways and traffic.
Pre-requisite: CE 204 Minimum Grade of C and CE 205 Minimum Grade of C and ST 315 Minimum Grade of C.
- CE 353 Transp-Geometric Design** 3 cr
Basic principles and techniques of highway design, including route layout, alignment, intersection design, and materials/earthwork estimation. Use of computer tools to generate and analyze highway designs.
Pre-requisite: CE 352 Minimum Grade of D.
- CE 360 Water Resources Engineering I** 2 cr
The application of fluid mechanics and other science and engineering disciplines in the development of structures, projects, and systems involving water resources. Introductions to open-channel flow, closed-conduit flow, hydraulic structures, hydraulic machinery, and groundwater flow. Fee.
Co-requisite: CE 367
Pre-requisite: EG 360 Minimum Grade of D.
- CE 367 Hydraulics Laboratory - W** 1 cr
Laboratory and field measurement of fluid and flow properties; hydraulic laboratory practice and model stimulation techniques.
Co-requisite: CE 360
Pre-requisite: EG 360 Minimum Grade of D or CE 365 Minimum Grade of D.
- CE 370 Intro to Enviro Eng** 3 cr
Introduction to the fundamentals of water quality characterization, water pollution hazardous waste management, water and wastewater treatment, solid waste management, waste minimization and control.
Co-requisite: CE 374
Pre-requisite: CH 132 Minimum Grade of C and MA 238 Minimum Grade of D.
- CE 374 Intro to Enviromental Eng Lab** 1 cr
Introduction to specific physical, chemical, and microbiological methods of analysis common to environmental engineering; including laboratory and field measurement of water quality characteristics and interpretation of results.
Co-requisite: CE 370
Pre-requisite: CH 132 Minimum Grade of C and MA 238 Minimum Grade of D.
- CE 384 Structural Analysis** 3 cr
Analysis of statically determinate structures such as trusses, beams, and frames including the calculation of deflections. Introduction to analysis of indeterminate structures.
Co-requisite: CE 385
Pre-requisite: EG 315 Minimum Grade of D.
- CE 385 Structural Analysis Lab** 1 cr
Modeling and analysis of determinate and indeterminate structures. Use of state-of-the-art structural analysis software.
Co-requisite: CE 384
Pre-requisite: EG 315 Minimum Grade of D.
- CE 410 Construction Engineering** 3 cr
An introduction to the construction industry and the role of civil engineering in construction. Construction engineering methods including preparation of cost estimates, critical path scheduling and resource allocation. Instructor permission. Fee.

- CE 412 Mgmt & Sustainability of C.I.** 3 cr
Management and sustainability of Civil infrastructure is designed to present an overview of infrastructure engineering and management systems and to use project management, decision support tools, and life cycle costing tools in connection with infrastructure planning and assessment. Students will be presented with the understanding that achieving sustainability requires the consideration to meeting present and future human needs and respecting "triple bottom line: economic, social, and environmental goals. The course also provides a review of several important design and management tools to support sustainable development and communities.
- CE 431 Civil Engineering Design I** 2 cr
Introduction to the practice of civil engineering and the engineering design process. In depth consideration of ethical issues in engineering practice. Participation in engineering design teams for project planning, proposal development, and completion of a feasibility study. Written and oral presentations of results. Senior Capstone Course. Fee.
Co-requisite: CE 440, CE 460, CE 470, CE 480
Pre-requisite: CE 352 Minimum Grade of D or CE 353 Minimum Grade of D or CE 443 Minimum Grade of D or CE 485 Minimum Grade of D. CE 352 and CE 443 and CE 485 can be taken concurrently with this course.
- CE 432 Civil Engineering Design II** 4 cr
A multidisciplinary development of a project involving analysis and design in Civil Engineering. Implementation of design concepts and methodologies from conception to final design. Completion of a comprehensive design project including cost estimates, oral and written presentation of results. A senior capstone course. Fee.
Pre-requisite: CE 431 Minimum Grade of D.
- CE 440 Intro to Geotech Eng** 3 cr
An Introduction to Geotechnical Engineering designed to provide tools to analyze geomechanical and geohydraulic problems associated with the design of foundations, retaining structures, slopes and other geotechnically related designs.
Pre-requisite: CE 340 Minimum Grade of D and CE 341 Minimum Grade of D. CE 340 can be taken concurrently with this course.
- CE 442 Foundation Engineering** 3 cr
Principles of foundation analysis, design and construction in engineering practice.
Pre-requisite: CE 440 Minimum Grade of D.
- CE 452 Transportation Geometric Design** 3 cr
This course will provide students with an understanding of the basic principles and techniques of highway design. This will include laying out potential routes, design of the alignment and intersections, and evaluation of earthwork requirements. The student should be able to understand and apply these principles to highway design problems. The student should also be able to use existing computer tools to generate and analyze designs. Upon completion, students should be prepared to work in the field of highway design. Fee.
Pre-requisite: CE 352 Minimum Grade of D.
- CE 460 Water Resources Engineering II** 3 cr
The application of hydrologic and hydraulic principles for hydrologic analysis, frequency analysis, flood routing, hydrologic simulation, urban hydrology, floodplain hydraulics, and coastal engineering.
Pre-requisite: CE 360 Minimum Grade of D and CE 367 Minimum Grade of D.
- CE 466 Coastal and Harbor Eng** 3 cr
An introduction to the principles of coastal hydraulic and sedimentary processes and the design of coastal and harbor works such as ship channels, marinas, jetties, breakwaters, groins, seawalls and beach nourishment projects.
Pre-requisite: CE 460 Minimum Grade of D. CE 460 can be taken concurrently with this course.
- CE 470 Water-Wastewater Trtmnt Design** 3 cr
Development of the principles of design for components of water supply and wastewater treatment facilities, including drinking water distribution and wastewater collection systems.
Co-requisite: CE 471
Pre-requisite: CE 360 Minimum Grade of D and CE 370 Minimum Grade of D and CE 374 Minimum Grade of D.
- CE 471 Water-Wastewater Design Lab** 1 cr
Application of design principles and criteria to analyze, design, and evaluate water and wastewater treatment facility components, including water distribution and wastewater collection systems.
Co-requisite: CE 470
Pre-requisite: CE 360 Minimum Grade of D and CE 370 Minimum Grade of D and CE 374 Minimum Grade of D.
- CE 474 Industrial Waste Treatment** 3 cr
Topics in Industrial Waste Treatment unit processes and their design, including those addressing wastewater treatment, air pollution control, solid waste, and hazardous management.
Pre-requisite: CE 470 Minimum Grade of D.
- CE 480 Design of Steel Structures** 3 cr
Design of Steel Trusses, Girders, Building Frames, and other Steel Structures.
Co-requisite: CE 481
Pre-requisite: CE 384 Minimum Grade of D and CE 314 Minimum Grade of D and CE 315 Minimum Grade of D.

- CE 481 Steel Design Lab** 1 cr
Application of structural steel design methods to specific cases.
Co-requisite: CE 480
Pre-requisite: CE 384 Minimum Grade of D and CE 314 Minimum Grade of D and CE 315 Minimum Grade of D.
- CE 482 Timber Design** 3 cr
This course will cover the design of timber structures. Design loads, structural behavior, properties and grades of wood will be covered. Design of beams, columns, diaphragms, shearwalls, structural glued laminated timber, and structural connections. Instructor Approval Required
Pre-requisite: CE 384 Minimum Grade of D and CE 385 Minimum Grade of D.
- CE 485 Reinforced Concrete Design** 3 cr
Fundamentals of reinforced concrete analysis and design. Design of beams, one-way slabs, short columns, and single footings. Calculations of cracking and deflection of beams.
Co-requisite: CE 486
Pre-requisite: CE 384 Minimum Grade of D and CE 314 Minimum Grade of D and CE 315 Minimum Grade of D.
- CE 486 Reinforced Concrete Design Lab** 1 cr
Integrated reinforced concrete design problems similar to those found in practice will be presented. Students will solve similar problems in class during the lab period.
Co-requisite: CE 485
Pre-requisite: CE 384 Minimum Grade of D and CE 314 Minimum Grade of D and CE 315 Minimum Grade of D.
- CE 490 Special Topics** 1 TO 4 cr
Topics of current civil engineering interest.
- CE 494 Directed Studies** 1 TO 4 cr
Directed study, under the guidance of a faculty advisor, of a topic from the field of civil engineering not offered in a regularly scheduled course. Requires department chair permission.
- CE 499 Honors Senior Project** 1 TO 6 cr
Under the advice and guidance of a faculty mentor, honors students will identify and carry out a research project, relevant to the field of Civil Engineering study, that will lead to a formal presentation at the Annual Honors Student Colloquium. The senior project will be judged and graded by three faculty, chaired by the honors mentor. This course is required for Honors recognition. A minimum of 4 credit hours is required, but a student may enroll for a maximum of 6 credit hours over two semesters. Prerequisites: Completion of the most advanced required course in the subdiscipline of the project (CE 440, CE 366, CE 470, or CE 384) and completion of an approved project prospectus.
Pre-requisite: CE 352 Minimum Grade of C or CE 366 Minimum Grade of D or CE 384 Minimum Grade of C or CE 443 Minimum Grade of C or CE 470 Minimum Grade of C.
- CE 503 Intro to Coastal Engineering** 3 cr
This graduate course provides students with an introduction to the coastal design environment. The goal of this course is to orient civil engineers, or students from related degree programs, to fundamental coastal engineering concepts. These concepts are important as they make the practice of civil engineering unique due to the complex tide, wave, and sediment characteristics found along the coast. These coastal systems are dynamic, ecologically sensitive, critical to the nation's economy, and are highly vulnerable to storms and the impacts of climate change.
- CE 510 Construction Engineering** 3 cr
An introduction to the construction industry and the role of civil engineering in construction. Construction engineering methods including preparation of cost estimates, critical path scheduling and resource allocation. Instructor permission required.
- CE 512 Mgmt & Sustainability of Infr** 3 cr
This course is designed to present an overview of infrastructure systems and how to manage and maintain these systems. Project management, decision support tools, and life cycle costing tools will be presented, in connection with infrastructure planning and assessment. Infrastructure sustainability will also be addressed, particularly considering the "triple bottom line" of economic, social, and environmental goals. The course also provides a review of several important design and management tools to support sustainable development and communities. A course project is required.
- CE 540 Advanced Soil Mechanics** 3 cr
Shearing strength and deformation behavior of soils with applications to retaining structures, slopes and bearing capacity. Behavior of cohesionless soils and cohesive soils under drained and undrained conditions. Permeability, steady state flow and effective stress in soils. Consolidation theory.
Pre-requisite: CE 440 Minimum Grade of C.
- CE 542 Foundation Engineering** 3 cr
This course is to provide advanced knowledge of selected geotechnical principals for analysis, design and construction of a variety of foundations systems. This course is dually listed with an equivalent 400 level course(CE 442). Fee.
Pre-requisite: CE 440 Minimum Grade of C.
- CE 547 Groundwater** 3 cr
Principals of fluid flow through porous media, well hydraulics. Ground water contamination, including principals that govern fate, transport, and remediation. Fee.
Pre-requisite: CE 340 Minimum Grade of C and CE 470 Minimum Grade of C.

CE 551 Traffic Engineering 3 cr

This course will focus on traffic flow parameters and their influence on roadway traffic conditions, with emphasis on traffic data collection, traffic safety analysis, roadway markings, traffic signs, traffic signal timing and signal capacity analysis, and traffic management systems. Pre-requisite: CE 352 Minimum Grade of C.

CE 552 Transportation Geometric Design 3 cr

This course will provide students with an understanding of the basic principles and techniques of highway design. This will include laying out potential routes, design of the alignment and intersections, and evaluation of earthwork requirements. The student should be able to understand and apply these principles to highway design problems. The student should also be able to use existing computer tools to generate and analyze designs. Upon completion, students should be prepared to work in the field of highway design. This course is dually listed with an equivalent 400 level course (DE 452). Fee. Pre-requisite: CE 352 Minimum Grade of C.

CE 553 Transportation Systems Eval 3 cr

This course will focus on concepts and principles of transportation economic analysis, transportation costs and benefits, user and nonuser consequences, methods of evaluation of plans and projects, environmental impact assessments, and transportation programming and management. Requires Instructor Permission.

CE 560 Coastal Hydrodynamics 3 cr

Theory and analysis of advanced coastal and estuarine hydrodynamics. Potential topics to be covered include: wave mechanics; tidal dynamics; coastal and estuarine circulation; and transport and mixing in coastal waters. Pre-requisite: CE 501 Minimum Grade of C.

CE 563 Hydrodynamic Modeling 3 cr

Theory and application of numerical models to coastal hydrodynamics. Potential topics to be covered include: overview of numerical simulation techniques; wave transformation processes; engineering wave models; principles of circulation; and advanced circulation models. Pre-requisite: CE 501 Minimum Grade of C.

CE 566 Coastal and Harbor Engineering 3 cr

Advanced principles of coastal hydraulic and sedimentary processes and the design of coastal and harbor works such as ship channels, marina, jetties, breakwaters, groins, seawalls, and beach nourishment projects. This course is dually listed with an equivalent 400 level course (CE 466). Fee. Pre-requisite: CE 460 Minimum Grade of C and CE 501 Minimum Grade of C.

CE 571 Biological Wastewater Treatmnt 3 cr

Theory, analysis and design criteria of biological treatment systems for municipal and industrial wastewaters, including suspended and attached growth processes in both the aerobic and anaerobic environments. Pre-requisite: CE 470 Minimum Grade of C.

CE 572 Physical Wastewater Treatment 3 cr

Advanced theory and applications in physical and chemical wastewater treatment. Topics covered include mass balance; reactor design, modeling, and analysis; filtration; mixing and flocculation; flotation; dissolved oxygen transfer optimization; chemical treatment of nutrient loads; disinfection; and residuals management. Pre-requisite: CE 470 Minimum Grade of C.

CE 574 Industrial Waste Treatment 3 cr

Topics in Industrial Waste Treatment unit processes and their design, including those addressing waste water treatment, air pollution, solid waste, and hazardous waste management. This course is dually listed with an equivalent 400 level course (CE 474). Credit for both CE 474 and CE 574 is not permitted. Fee. Pre-requisite: CE 470 Minimum Grade of C.

CE 579 Fundamentals Environmental Eng 3 cr

Fundamentals of water quality characterization, water pollution, hazardous waste management, water and wastewater treatment, solid waste management, and waste minimization and control. This course includes a comprehensive project in addition to the lecture class. Note: This course is a core course for MS degree students in the Environmental Toxicology Program and not intended for Engineering Majors. Instructor Permission. (This course is dual listed with CE 370.) Fee. Pre-requisite: (CH 116 Minimum Grade of C or CH 132 Minimum Grade of C).

CE 580 Steel Design 3 cr

Design of steel trusses, girders, building frames, and other steel structures. This course is dually listed with an equivalent 400 level course (CE 480). Fee. Co-requisite: CE 581 Pre-requisite: CE 384 Minimum Grade of C or CE 385 Minimum Grade of C.

CE 581 Steel Design Lab 1 cr

Application of structural steel design methods to specific cases. This course is dually listed with an equivalent 400 level course (CE 481). Fee. Co-requisite: CE 580 Pre-requisite: CE 384 Minimum Grade of C and CE 385 Minimum Grade of C.

CE 582 Timber Design 3 cr

This course will cover the design of timber structures. Design loads, structural behavior, properties and grades of wood will be covered. Design of beams, columns, diaphragms, shearwalls, structural glued laminated timber, and structural connections. This course is dually listed with an equivalent 400 level course (CE 482). Instructor Approval Required.

CE 583 Advanced Steel Design 3 cr

This course covers the design of built-up members, composite beams, columns and floors. Design of advanced bolted and welded connections will also be covered. Students will use state-of-the-art software to model and design complex steel structures.
Pre-requisite: CE 480 Minimum Grade of C or CE 481 Minimum Grade of C.

CE 584 Advanced Structural Analysis 3 cr

Students will be introduced to the analysis of indeterminate structures using classical and matrix methods. Students will also be introduced to advanced structural modeling techniques using state-of-the-art software. Fee.
Pre-requisite: CE 384 Minimum Grade of C and CE 385 Minimum Grade of C.

CE 585 Concrete Design 3 cr

Fundamentals of reinforced concrete analysis and design. Design of beams, one-way slabs, short columns, and single footings. Calculations of cracking and deflection of beams. This course is dually listed with an equivalent 400 level course (CE 485). Fee.
Co-requisite: CE 586
Pre-requisite: CE 384 Minimum Grade of C or CE 385 Minimum Grade of C.

CE 586 Concrete Design Lab 1 cr

Integrated reinforced concrete design problems similar to those found in practice will be presented. Students will solve similar problems in class during the lab period. This course is dually listed with an equivalent 400 level course (CE 486). Fee.
Co-requisite: CE 585
Pre-requisite: CE 384 Minimum Grade of C and CE 385 Minimum Grade of C.

CE 587 Advanced Concrete Design 3 cr

Students will be introduced to the analysis and design of reinforced concrete footings, retaining walls, two-way floor systems, long columns, beams subjected to torsion and deep beams. Fee.
Pre-requisite: CE 485 Minimum Grade of C and CE 486 Minimum Grade of C.

CE 588 Prestressed Concrete Design 3 cr

Students will be introduced to the concepts of prestressing, loss of prestress, design of prestressed beams, columns and slabs. Fee.
Pre-requisite: CE 485 Minimum Grade of C and CE 486 Minimum Grade of C.

CE 590 Special Topics - 1 TO 4 cr

Topics of current civil engineering interest.

CE 592 Directed Independent Study - 1 TO 3 cr

Directed study, under the guidance of a faculty advisor, of a topic from the field of Civil Engineering not offered in a regularly scheduled course. Requires Instructor Permission. Fee.

CE 594 Projects in Civil Engineering 1 TO 3 cr

May be repeated for credit. Requires approved proposal and consent of director of engineering graduate studies. Fee.

CE 599 Thesis 1 TO 6 cr

Thesis research. May be taken more than once. Requires approved prospectus. Fee.

Faculty

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