The Civil, Construction, and Environmental Engineering (CCEE) department offers master's and doctoral level programs as well as graduate certificates. Graduate students are exposed to cutting-edge research covering various facets of Civil Engineering theory and practice. Knowledgeable and experienced faculty members work closely with students to provide them with the tools required to succeed professionally in globally-competitive work environments.

<table>
<thead>
<tr>
<th>Program</th>
<th>Coordinator</th>
<th>Room</th>
<th>Phone Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Certificates</td>
<td>Fouad Fouad, PhD</td>
<td>Hoehn</td>
<td>(205) 934-8430; <a href="mailto:ffouad@uab.edu">ffouad@uab.edu</a></td>
</tr>
</tbody>
</table>

Category A certificates are offered by the Civil, Construction, and Environmental Engineering Department. Any undergraduate or graduate student in good standing who is pursuing a Civil Engineering degree (BSCE, MSCE, or PhD) may elect to simultaneously complete the requirements of his or her degree program and the Certificate Program. These certificates are listed on student transcripts and in the university graduation bulletin. Certificates can be earned in:

- Construction Engineering Management
- Environmental Engineering
- Geotechnical Engineering
- Structural Engineering
- Sustainable Engineering
- Transportation Engineering

Civil Engineering (BSCE) graduates who complete the Certificate Program will have greater depth in a specific technical area. The certificates also allow a means for practicing engineers to acquire expertise beyond a Bachelor’s degree, and have it formally recognized without completing a program leading to a Master’s degree. This technical expertise will enhance their proficiency and marketability. Up to 12 graduate level credit hours taken for a certificate may be applied toward the MSCE degree.

The requirements are as follows:

- Students must be admitted to the Department as either undergraduate (BSCE) or graduate (MSCE) students in Civil, Construction, and Environmental Engineering or hold a BS in Civil Engineering or a closely related field from an accredited institution.
- Certificates require a minimum of 15 semester hours consisting of one required undergraduate course (which will also count toward the BSCE degree at UAB) and four graduate level elective courses in the area of specialization.
- Graduate level elective courses taken may be applied to the certificate as well as a MSCE degree.
- One course, up to three semester hours, may be transferred from another institution: this may be the required course.
- Courses taken from UA, USA, and UAH by IITS may be applied to certificates.
- Elective course may be taken at the 500, 600, or 700 level.

### Certificate in Construction Engineering Management

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required Course</td>
<td></td>
</tr>
<tr>
<td>CE 497 Construction Engineering Management</td>
<td>3</td>
</tr>
<tr>
<td>Electives</td>
<td>12</td>
</tr>
</tbody>
</table>

Select from the following:

- CE 575 Construction Safety and Health Management
- CE 600 Sustainable Construction
- CECM 669 Advanced Project Management
- CECM 671 Construction Liability & Contracts
- CECM 672 Construction Methods and Equipment
- CECM 673 Project Planning and Control
- CECM 674 Green Building Design/Construction
- CECM 675 Advanced Construction and Engineering Economics
- CECM 676 Construction Project Risk Management
- CECM 688 Construction Management and Leadership Challenges in the Global Environment
- CECM 689 Building Information Modeling (BIM) Techniques

### Certificate in Environmental Engineering

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required Course</td>
<td></td>
</tr>
<tr>
<td>CE 236 Environmental Engineering</td>
<td>3</td>
</tr>
<tr>
<td>Electives</td>
<td>12</td>
</tr>
</tbody>
</table>

Select from the following:

- CE 530 Water Supply/Drainage Design
- CE 533 Solid and Hazardous Wastes Management
- CE 534 Air Quality Modeling and Monitoring
- CE 580 Introduction to Water and Wastewater Treatment
- CE 640 Wastewater Treatment Engineering
- CE 685 Engineering Hydrology

### Certificate in Geotechnical Engineering

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required Course</td>
<td></td>
</tr>
<tr>
<td>CE 332 Soil Engineering</td>
<td>4</td>
</tr>
<tr>
<td>Electives</td>
<td>12</td>
</tr>
</tbody>
</table>

Select from the following:

| CE 526 Foundation Engineering |
| CE 690 Special Topics in (Area) |
| CECM 669 Advanced Project Management |
| CECM 671 Construction Liability & Contracts |

1 Must be approved by Certificate Director

### Certificate in Structural Engineering

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required Course</td>
<td></td>
</tr>
<tr>
<td>CE 360 Structural Analysis</td>
<td>3</td>
</tr>
<tr>
<td>Electives</td>
<td>12</td>
</tr>
</tbody>
</table>

Select from the following:

- CE 516 Mechanical Vibrations
- CE 520 Advanced Mechanics
- CE 526 Foundation Engineering
The following three concentrations in the online Master in Engineering program are offered through the Department of Civil, Construction, and Environmental Engineering:

- Construction Engineering Management
- Structural Engineering
- Sustainable Smart Cities

Special Topics (590/690/790) courses and Independent Study (591/691/791) courses are reviewed for degree applicability for each program in the School of Engineering. No more than 6 combined hours of Special Topics and/or Independent Study courses will be applied to the MSBME without appeal to and approval from the Program Director.

The School of Engineering offers similar courses at the 400/500 and 600/700 levels. While the higher numbered course has more advanced content, there is a significant overlap in topics. Therefore, students are not allowed to take a 500-level or 700-level course for credit if they have previously taken the related 400-level or 600 level course, respectively.
3. Three letters of recommendation from professional contacts which speak to your character, work ethic, and why the writer believes you will succeed in graduate school.

4. Personal essay detailing motivation and career aspirations for earning the degree.

5. Résumé/Curriculum Vitae

6. NO GRE REQUIRED

7. For applicants whose first language is not English, TOEFL score of 80 (with a minimum score of 18 on each subsection) or higher OR IELTS score of 6.5 or higher (Institution code – 1856, applicable to TOEFL only)

To apply: Visit the UAB Graduate School website and click the ‘Apply Now’ button. Choose Construction Engineering Management in the Program Applying To section.

### Pre-Defined Table

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CECM 669 Advanced Project Management</td>
<td>3</td>
</tr>
<tr>
<td>CECM 670 Construction Estimating and Bidding</td>
<td>3</td>
</tr>
<tr>
<td>CECM 671 Construction Liability &amp; Contracts</td>
<td>3</td>
</tr>
<tr>
<td>CECM 672 Construction Methods and Equipment</td>
<td>3</td>
</tr>
<tr>
<td>CECM 673 Project Planning and Control</td>
<td>3</td>
</tr>
<tr>
<td>CECM 674 Green Building Design/Construction</td>
<td>3</td>
</tr>
<tr>
<td>CECM 675 Advanced Construction and Engineering Economics</td>
<td>3</td>
</tr>
<tr>
<td>CECM 676 Construction Project Risk Management</td>
<td>3</td>
</tr>
<tr>
<td>CECM 688 Construction Management and Leadership Challenges in the Global Environment</td>
<td>3</td>
</tr>
<tr>
<td>CECM 689 Building Information Modeling (BIM) Techniques</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total Hours</strong></td>
<td><strong>30</strong></td>
</tr>
</tbody>
</table>

### Master of Engineering with a concentration in Construction Engineering Management

**Please Note:** All Master of Engineering concentrations are 100% online. There are no campus classes or required on-campus meetings or activities. Course delivery includes asynchronous and synchronous learning modes.

### Admission Requirements

In addition to the Graduate School admission requirements, requirements for admission to the UAB MEng-SSC program includes the following:

1. A Bachelor’s degree (or equivalent) from a recognized institution of higher education in an appropriate subject/related science including but not limited to: Urban Design and Planning, Political Science, Geography, Environmental Science, Environmental Management, Public Health, Social Sciences, Criminal Justice, Information and Communication Technology, and/or Engineering.

2. Candidates who have related employment or substantial industrial experience, with a demonstrable interest in or a commitment to urban planning, sustainability and environmental management issues, and/or smart city approaches will also be considered.

3. All program students will be required to register / enroll at both UAB and Staffordshire University (SU). Details on the Graduate application packet are available online.

4. For applicants whose first language is not English, TOEFL score of 80 (with a minimum score of 18 on each subsection) or higher OR IELTS score of 6.5 or higher (Institution code – 1856, applicable to TOEFL only)

### Sustainable Smart Cities Concentration

**Please Note:** All Master of Engineering concentrations are 100% online. There are no campus classes or required on-campus meetings or activities. Course delivery includes asynchronous and synchronous learning modes.

### Structural Engineering Concentration

**Please Note:** All Master of Engineering concentrations are 100% online. There are no campus classes or required on-campus meetings or activities. Course delivery includes asynchronous and synchronous learning modes.
The Master of Engineering with a concentration in Structural Engineering is designed to increase the technical knowledge of engineering professionals working in or desiring to work in the broad field of structural engineering.

Admission Requirements

In addition to the Graduate School admission requirements, requirements for admission to the UAB MEng-STR program include the following:

1. A civil or mechanical engineering bachelor's degree from an ABET accredited U.S. college or university or a bachelor's degree in a closely related science
2. An undergraduate GPA of 3.0 or higher (individuals not meeting this requirement but who have a strong professional background, references, and interview may be admitted)
3. Three letters of recommendation concerning the applicant's previous academic and professional work;
4. Scores on the GRE General Test are not required (but are accepted) for applicants who received a BS degree from a program accredited by the Engineering Accreditation Committee of ABET (http://www.abet.org), or from other programs with reciprocal agreement under the Washington Accord (http://www.ieagreements.org/accords/washington). The GRE General Test is required for all other applicants.
5. Verification of registration by examination as a Professional Engineer (PE) will satisfy criteria 4 above.
6. A full-time student is one who is enrolled in at least 9 credit hours per semester.

Admission Requirements

In addition to the UAB Graduate School admission requirements, admission to the Master's of Science in Civil Engineering degree include the following five criteria:

1. An undergraduate engineering degree from an ABET accredited engineering program or applied science program. Applicants who have an outstanding academic record in an unaccredited engineering or applied science degree program may be admitted at program discretion. Students admitted from this category may be required to complete a sequence of undergraduate courses in addition to the normal requirements of the MSCE degree. This set of extra requirements will be specified in writing at the time of admission to the program.
2. GPA of 3.0 or better on a 4.0 scale in all undergraduate degree major courses attempted;
3. Three letters of recommendation concerning the applicant's previous academic and professional work;
4. Scores on the GRE General Test are not required (but are accepted) for applicants who received a BS degree from a program accredited by the Engineering Accreditation Committee of ABET (http://www.abet.org), or from other programs with reciprocal agreement under the Washington Accord (http://www.ieagreements.org/accords/washington). The GRE General Test is required for all other applicants.
5. In addition, a minimum score of 80 on the TOEFL or a 6.5 on the IELTS is required for international applicants whose native language is not English.
6. Verification of registration by examination as a Professional Engineer (PE) will satisfy criteria 4 above.

Program Requirements

The following minimum requirements apply to the plan of study for a student who has earned a baccalaureate degree in civil engineering. A student with an undergraduate degree in another field may also be accepted into the civil engineering program but will normally have to take additional preparatory coursework as part of an expanded plan of study. Continuous enrollment for at least 3 credit hours per term is required. Students receiving a research assistantship are required to be enrolled as full-time students. A full-time student is one who is enrolled in at least 9 credit hours per semester.

Special Topics (590/690/790) courses and Independent Study (591/691/791) courses are reviewed for degree applicability for each program in the School of Engineering. No more than 6 combined hours of Special Topics and/or Independent Study courses will be applied to the MSBME without appeal to and approval from the Program Director.

The School of Engineering offers similar courses at the 400/500 and 600/700 levels. While the higher numbered course has more advanced
content, there is a significant overlap in topics. Therefore, students are not allowed to take a 500-level or 700-level course for credit if they have previously taken the related 400-level or 600 level course, respectively.

Master of Science in Civil Engineering

Plan I (Thesis Option)
1. In addition to the general Graduate School requirements, the student must successfully complete at least 33 semester hours of graduate credit, including:
   a) A minimum of 18 semester hours in civil engineering;
   b) Up to 6 semester hours in disciplines outside civil engineering, such as other engineering disciplines, mathematics, biology, earth science, physics, urban affairs, or public health;
   c) A minimum of 9 hours of CE 699-Masters Thesis Research.

2. All Plan I Master’s students are required to complete online modules covering the 9 topic areas of RCR research integrity. The modules can be accessed online at https://www.citiprogram.org.

Plan II (Non-Thesis Option):
The student must successfully complete at least 33 semester hours of graduate credit including:
- A minimum of 24 semester hours in civil engineering;
- Up to 6 semester hours in disciplines outside civil engineering, such as: other engineering disciplines, mathematics, biology, earth sciences, physics, chemistry, or public health; and
- A minimum of 3 hours of CE 698 – Non-Thesis Research under the direction of the graduate study committee chair, resulting in a committee approved written report.

Areas of Specialization
The department offers specialization programs in the fields of structural engineering/structural mechanics, environmental engineering, transportation engineering, and construction engineering management. Supporting courses are offered in geotechnical engineering, optimization, engineering law and other areas. If a student chooses to declare a concentration, the student must choose from the courses listed below the appropriate concentration to fulfill the required 18 hours (Plan I) or 24 hours (Plan II) within civil engineering.

Concentration in Structural Engineering

Requirements

<table>
<thead>
<tr>
<th>Select 18 hours for Plan I or 24 hours for Plan II</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CE 516 Mechanical Vibrations</td>
<td>3</td>
</tr>
<tr>
<td>CE 520 Advanced Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>CE 526 Foundation Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CE 544 Civil Engineering Analysis II</td>
<td>3</td>
</tr>
<tr>
<td>CE 553 Design of Wood Structures</td>
<td>3</td>
</tr>
<tr>
<td>CE 554 Design of Masonry Structures</td>
<td>3</td>
</tr>
<tr>
<td>CE 556 Prestressed Concrete Design</td>
<td>3</td>
</tr>
<tr>
<td>CE 557 Concrete Technology</td>
<td>3</td>
</tr>
<tr>
<td>CE 560 Structural Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>CE 561 Introduction to the Finite Element Method</td>
<td>3</td>
</tr>
<tr>
<td>CE 562 Advanced Structural Analysis</td>
<td>3</td>
</tr>
<tr>
<td>CE 564 Structural Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>CE 590 Special Topics in Civil Engineering 1</td>
<td>3</td>
</tr>
<tr>
<td>CE 612 Theory of Elasticity</td>
<td>3</td>
</tr>
<tr>
<td>CE 617 Theory of Plates and Shells</td>
<td>3</td>
</tr>
<tr>
<td>CE 641 Civil Engineering Seminar 2</td>
<td>0</td>
</tr>
<tr>
<td>CE 650 Advanced Structural Steel</td>
<td>3</td>
</tr>
<tr>
<td>CE 655 Advanced Reinforced Concrete</td>
<td>3</td>
</tr>
<tr>
<td>CE 690 Special Topics in (Area) 1</td>
<td>1-3</td>
</tr>
<tr>
<td>CE 691 Individual Study in (Area) 1</td>
<td>1-4</td>
</tr>
</tbody>
</table>

1 or any CE 590/690 IITS course offerings from UAH, USA, and UA campuses with Program Director approval

Concentration in Environmental Engineering

Requirements

<table>
<thead>
<tr>
<th>Select 18 hours for Plan I or 24 hours for Plan II</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CE 530 Water Supply/Drainage Design</td>
<td>3</td>
</tr>
<tr>
<td>CE 531 Energy Resources</td>
<td>3</td>
</tr>
<tr>
<td>CE 533 Solid and Hazardous Wastes Management</td>
<td>3</td>
</tr>
<tr>
<td>CE 534 Air Quality Modeling and Monitoring</td>
<td>3</td>
</tr>
<tr>
<td>CE 537 Environmental Experimental Design and Field Sampling</td>
<td>3</td>
</tr>
<tr>
<td>CE 580 Introduction to Water and Wastewater Treatment</td>
<td>3</td>
</tr>
<tr>
<td>CE 585 Engineering Hydrology</td>
<td>3</td>
</tr>
<tr>
<td>CE 590 Special Topics in Civil Engineering 1</td>
<td>3</td>
</tr>
<tr>
<td>CE 600 Sustainable Construction</td>
<td>3</td>
</tr>
<tr>
<td>CE 608 Green Building Design</td>
<td>3</td>
</tr>
<tr>
<td>CE 610 The Engineered Environment</td>
<td>3</td>
</tr>
<tr>
<td>CE 638 Stormwater Pollution Management</td>
<td>3</td>
</tr>
<tr>
<td>CE 640 Wastewater Treatment Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CE 641 Civil Engineering Seminar 2</td>
<td>0</td>
</tr>
<tr>
<td>CE 690 Special Topics in (Area) 1</td>
<td>1-3</td>
</tr>
<tr>
<td>CE 691 Individual Study in (Area) 1</td>
<td>1-4</td>
</tr>
</tbody>
</table>

1 or any CE 590/690 IITS course offerings from UAH, USA, and UA campuses with Program Director approval

Concentration in Transportation Engineering

Requirements

<table>
<thead>
<tr>
<th>Select 18 hours for Plan I or 24 hours for Plan II</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CE 543 Pavement Design &amp; Construction</td>
<td>3</td>
</tr>
<tr>
<td>CE 590 Special Topics in Civil Engineering 1</td>
<td>3</td>
</tr>
<tr>
<td>CE 621 Transportation Engineering Seminar</td>
<td>1</td>
</tr>
<tr>
<td>CE 622 Traffic Flow Theory</td>
<td>3</td>
</tr>
<tr>
<td>CE 624 Simulation Models for Transportation Applications</td>
<td>3</td>
</tr>
<tr>
<td>CE 625 Intelligent Transportation Systems</td>
<td>3</td>
</tr>
<tr>
<td>CE 646 Traffic Engineering Operations</td>
<td>3</td>
</tr>
<tr>
<td>CE 641 Civil Engineering Seminar 2</td>
<td>0</td>
</tr>
<tr>
<td>CE 648 Urban and Transportation Planning</td>
<td>3</td>
</tr>
<tr>
<td>CE 690 Special Topics in (Area) 1</td>
<td>1-3</td>
</tr>
<tr>
<td>CE 691 Individual Study in (Area) 1</td>
<td>1-4</td>
</tr>
</tbody>
</table>

1 or any CE 590/690 IITS course offerings from UAH, USA, and UA campuses with Program Director approval

2 requirement of the Department for all graduate students to take at least once prior to graduation
The Department offers a variety of courses due to the focus areas under the Master of Science in Civil Engineering, which makes it difficult to designate all the courses in which students may enroll. Therefore, the lists above are not all-inclusive.

**Admission Requirements**

In addition to the UAB Graduate School admission requirements, requirements for admission to the program leading to the Master of Science in Civil Engineering degree include the following five criteria:

1. An undergraduate engineering degree from an ABET accredited program. Applicants who do not meet this criterion but who have an outstanding academic record in an engineering degree program not accredited by ABET, or in a baccalaureate degree program in a related field, may be admitted on probation. Students admitted in this category will be required to complete a sequence of undergraduate courses in addition to the normal requirements of the MSCE degree. This set of extra requirements will be specified in writing at the time of admission to the program.

2. GPA of 3.0 or better on a 4.0 scale in all undergraduate degree major courses attempted;

3. Three letters of evaluation concerning the applicant's previous academic and professional work; and

4. The School of Engineering is waiving all GRE test requirements through at least Fall 2021. Previously, the MSBME program required the GRE general test for all applicants who did not receive a BS degree from a program accredited by the Engineering Accreditation Commission of ABET (http://www.abet.org), or from other programs with reciprocal agreement under the Washington Accord (http://www.ieagreements.org/accords/washington/).

5. In addition, a minimum score of 80 on the TOEFL (minimum 18 on each subsection) or a 6.5 on the IELTS is required for international applicants whose native language is not English.

6. Verification of registration by examination as a Professional Engineer (PE) will satisfy criteria 4 above.

**Program Requirements**

Special Topics (590/690/790) courses and Independent Study (591/691/791) courses are reviewed for degree applicability for each program in the School of Engineering. No more than 6 combined hours of Special Topics and/or Independent Study courses will be applied to the degree without appeal to and approval from the Program Director.

The School of Engineering offers similar courses at the 400/500 and 600/700 levels. While the higher numbered course has more advanced content, there is a significant overlap in topics. Therefore, students are not allowed to take a 500-level or 700-elevel course for credit if they have previously taken the related 400-level or 600 level course, respectively.

**Doctor of Philosophy in Civil Engineering**

This is a joint program with the University of Alabama in Huntsville (UAH). A typical student entering the program will already have an undergraduate degree in Civil Engineering from a program accredited by the Engineering Accreditation Commission of ABET. Students with outstanding records in related fields or from a non-accredited engineering program will be considered for admission on conditional standing and must remedy deficiencies in their preparation after the start of their academic program.

The program requires 48 credit hours of coursework beyond the baccalaureate level or 24 credit hours of coursework beyond the master's degree, plus a minimum of 24 credit hours of dissertation research (CE 799).

A minimum of 6 credit hours must be taken from the UAH campus and may be taken through the Intercampus Interactive Telecommunications System (IITS) at UAH, Distance Learning (DL) courses from UAH, or web-based Instruction from UAH.

Doctoral students are also required to successfully complete GRD 717 Principles of Scientific Integrity prior to admission to candidacy.

A Graduate Study Committee must be established by the doctoral student and must include a minimum of five graduate faculty members, at least one of which must be from UAH. A comprehensive examination is required of all doctoral candidates. This examination is conducted on the resident campus by the Graduate Study Committee after all coursework is successfully completed. The examination has both written and oral components. During the oral portion of the examination, the student also presents the dissertation proposal. The comprehensive examination may only be taken twice.

When the graduate student successfully passes the comprehensive examination, including the dissertation proposal, the student may apply to enter candidacy. Once a doctoral candidate, the student must complete a minimum of 24 graduate hours of dissertation research (CE 799) over the course of at least two semesters. Prior to admission of candidacy, the graduate can take research hours in the form of non-dissertation hours (CE 798); these non-dissertation research hours cannot be converted from non-dissertation research credits into dissertation research credits.

After successful completion of 24 hours of dissertation research, the graduate student must complete the dissertation for review by the Graduate Study Committee. The doctoral candidate must present an oral public defense of the dissertation. When the graduate student successfully defends the dissertation, the student then has ten working days to complete revisions and submit the approved document to the Graduate School.

All required coursework must be selected from the list below.

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CE 712 Theory of Elasticity</td>
<td>3</td>
</tr>
<tr>
<td>CE 715 Theory of Elastic Stability</td>
<td>3</td>
</tr>
<tr>
<td>CE 717 Theory of Plates and Shells</td>
<td>3</td>
</tr>
<tr>
<td>CE 721 Transportation Engineering Seminar</td>
<td>1</td>
</tr>
<tr>
<td>CE 722 Traffic Flow Theory</td>
<td>3</td>
</tr>
<tr>
<td>CE 723 Non-Motorized Transportation Design and Planning</td>
<td>3</td>
</tr>
<tr>
<td>CE 724 Simulation Models for Transportation Applications</td>
<td>3</td>
</tr>
<tr>
<td>CE 725 Intelligent Transportation Systems</td>
<td>3</td>
</tr>
<tr>
<td>CE 731 Environmental Law</td>
<td>3</td>
</tr>
<tr>
<td>CE 732 Industrial Waste and Wastewater Treatment</td>
<td>3</td>
</tr>
<tr>
<td>CE 736 Stormwater Pollution Management</td>
<td>3</td>
</tr>
<tr>
<td>CE 738 Water and Wastewater Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>CE 739 Sediment Sources and Controls</td>
<td>3</td>
</tr>
<tr>
<td>CE 740 Wastewater Treatment Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CE 749 Engineering Liability</td>
<td>3</td>
</tr>
<tr>
<td>CE 750 Advanced Structural Steel</td>
<td>3</td>
</tr>
<tr>
<td>CE 755 Advanced Reinforced Concrete</td>
<td>3</td>
</tr>
<tr>
<td>CE 758 Engineering Management</td>
<td>3</td>
</tr>
<tr>
<td>CE 763 Finite Element Methods</td>
<td>3</td>
</tr>
<tr>
<td>CE 781 Environmental Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>CE 782 Water Treatment Engineering</td>
<td>3</td>
</tr>
</tbody>
</table>
developing countries. Field trips.
role of electric utilities, transportation applications, and energy use in
for energy conservation; including electric power generation, changing
impacts, economies, policy, and technology. Concepts and opportunities
in terms of supply, distribution, recovery and conversion, environmental
Overview of the various energy resources: oil, natural gas, coal, nuclear,
CE 531. Energy Resources. 3 Hours.

Overview of the various energy resources: oil, natural gas, coal, nuclear,
hydro, solar, geothermal, biomass, wind, and ocean energy resources,
in terms of supply, distribution, recovery and conversion, environmental
impacts, economies, policy, and technology. Concepts and opportunities
for energy conservation; including electric power generation, changing
role of electric utilities, transportation applications, and energy use in
developing countries. Field trips.

CE 783 Water and Wastewater Treatment Processes Lab 3
CE 786 Engineering Hydrogeology 3
CE 787 Stormwater Detention Pond Design 3
CE 790 Special Topics in (Area) 1 1-3
CE 791 Individual Studies (In Area) 1 1-4

Other Requirements
GRD 717 Principles of Scientific Integrity 3
Dissertation Research 2 24
CE 799 Dissertation Research
PhD Students are required to complete two 3-credit hour courses offered
from UAH and may be taken through IITS, at UAB, UAH Distance
Learning, or web-based instruction from UAH
UAB PhD Students can also take CE 590 and CE 690 courses (see
Footnote 1)

1 Must have Program Director approval prior to registration
2 Minimum of 24 hours of Dissertation Research taken over at least
two semesters

CE-Civil Engineering Courses

CE 515. Building Information Modeling (BIM). 3 Hours.
This class provides an introduction to the virtual world of design and
construction. Topics covered include uses for technology, what is BIM,
and have a focus on AutoCAD and Revit Software. An emphasis is
placed on the use of these tools and their practical applications to the real
world environment. Students are provided with the software through the
Autodesk Student community and are required to complete a Multi-Step
term Project.

CE 516. Mechanical Vibrations. 3 Hours.
Free and forced single-degree-of-freedom systems. Multi-degree-of-
freedom systems. Damped, forced two-degree-of- freedom systems.
Simple continuous systems.

CE 520. Advanced Mechanics. 3 Hours.
Variation of stress at point including determination of principal and
maximum shear stresses. Basic problems involving symmetrical
deformation; thickwall cylinders, spheres, and rotating disk. Torsions of
noncircular sections. Curved beams. Failure Theories. Unsymmetrical
bending and shear center.

CE 526. Foundation Engineering. 3 Hours.
Application of principles of soil mechanics to: determine bearing capacity
and settlement of spread footings, mats, single piles and pile groups; site
investigation, evaluate data from field and laboratory tests; estimation
of stresses in soil masses; lateral resistance of piles and pile groups;
retaining walls, sheetpiles and coffer-dams.

CE 530. Water Supply/Drainage Design. 3 Hours.
Water requirements; wastewater characteristics. Hydraulics and design of
sewers; distribution, and reuse of water. Development of water supplies;
design considerations.

CE 531. Energy Resources. 3 Hours.
Overview of the various energy resources: oil, natural gas, coal, nuclear,
hydro, solar, geothermal, biomass, wind, and ocean energy resources,
in terms of supply, distribution, recovery and conversion, environmental
impacts, economies, policy, and technology. Concepts and opportunities
for energy conservation; including electric power generation, changing
role of electric utilities, transportation applications, and energy use in
developing countries. Field trips.

CE 532. Advanced Mechanics. 3 Hours.
Variation of stress at point including determination of principal and
maximum shear stresses. Basic problems involving symmetrical
deformation; thickwall cylinders, spheres, and rotating disk. Torsions of
noncircular sections. Curved beams. Failure Theories. Unsymmetrical
bending and shear center.

CE 533. Solid and Hazardous Wastes Management. 3 Hours.
Overview of waste characterizations, regulations, and management
options.

CE 534. Air Quality Modeling and Monitoring. 3 Hours.
Atmospheric pollutants; effects, reactions, and sources. Air pollution
meteorology and dispersion modeling. Ambient monitoring.

CE 537. Environmental Experimental Design and Field Sampling. 3 Hours.
Experimental design, sensitivity analyses, water sampling, and flow
monitoring. Receiving water chemical reactions. Field investigations.

CE 537L. Environmental Experimental Design and Field Sampling
Lab. 0 Hours.
Lab experiences in environmental experimental design and field
sampling.

CE 542. Hwy Materials and Construction. 3 Hours.
Properties of materials used in highway construction. Construction
methods and management.

CE 543. Pavement Design & Construction. 3 Hours.
Analysis of stresses and strains in pavement systems. Design and
construction of flexible and rigid pavements, base courses and
subgrades. Effects of loading on pavement life.

CE 544. Civil Engineering Analysis II. 3 Hours.
Sampling and experimental design. Hypotheses testing. Decision
Analyses. Multiple regression analyses. Nonparametric methods.
Analysis of experimental data in civil engineering research; regression,
experimental design, non-parametrical analysis.

CE 545. Engineering the Built Environment. 3 Hours.
This service learning course explores the effects the built environment
has on urban function, connectivity, community health, and the well-being
of its residents. Students work directly in Birmingham neighborhoods
learning how to assess different components of the built environment,
including transportation, green spaces, lighting, and blight, and to
estimate their impacts on community health and well-being. Students
then work with representatives from the City, neighborhoods, and
local industry to propose engineering solutions, develop realistic cost
estimates, assess potential benefits, and develop implementation plans.

CE 546. Green Infrastructure and Transportation. 3 Hours.
This course covers policy and technical issues related to sustainable
transportation. The course begins by discussing the concepts,
viewpoints, and fundamentals essential for understanding sustainable
transportation planning. Tools used to assess sustainability of
transportation facilities and neighborhoods are introduced next. The
course also presents design options in support of green infrastructure
and transportation, including livable street design, and traffic calming
applications. The course is expected to expand students’ knowledge
base on sustainable transportation issues and help them understand
the concept of sustainable transportation toward the development of
sustainable smart cities.

CE 547. Principles of Sustainable Development. 3 Hours.
The course presents the concepts, viewpoints and fundamentals
essential for understanding the urban sustainable development agenda.
Students will review basic earth sciences to better evaluate the impact
our anthropogenic activities have on the natural environment and
therefore how to minimize adverse future outcomes. Throughout the
course case studies of sustainable developments will be used to illustrate
the value, challenges and limitations of this concept. In the end, students
will possess the knowledge base needed to help advance sustainable
smart cities development.
CE 553. Design of Wood Structures. 3 Hours.
This course will give students an understanding of structural wood materials, both sawn lumber and a number of engineered wood materials. The main objective of the course is to learn how to design wood structures using these materials, including the design of beams, columns, connections, roof diaphragms, and shear walls. The requirement of the National Design Specification for Wood Structures will be addressed.

CE 554. Design of Masonry Structures. 3 Hours.
Design and detailing of masonry structures. Nomenclature, properties, and specifications for components. Design of assemblages, simple masonry structures, unreinforced and reinforced elements, and complex masonry structures.

CE 555. Prestressed Concrete Design. 3 Hours.
Principles and concepts of design in prestressed concrete including elastic limit strength analysis for flexural, shear, bond, and deflections. Principles of concordancy and linear transformation for indeterminate prestressed structures.

CE 556. Concrete Technology. 3 Hours.

CE 557. Concrete Technology. 3 Hours.
Elastic beam deflections, beam columns, lateral torsional buckling, column stability, plastic design, plate bending, yield line theory.

CE 558. Engineering Hydrology. 3 Hours.
Hydrologic principles including hydrology cycle, precipitation data, and disposal of sludge.

CE 559. Project Management. 3 Hours.
The International Research Experience for Students (IRES) program provides the opportunity for undergraduate and graduate students to participate in hands-on engineering research in an international setting. Students perform research on an approved topic related to civil engineering design in an international environment. Students select a topic, perform a detailed literature review, and work with mentors from UAB and the international host institution to develop research objectives and a detailed research plan. The course will culminate in a 6-8 week visit to the international host institution, during which time students will conduct hands-on research with their mentors and prepare final reports.

CE 560. Structural Mechanics. 3 Hours.
Analysis of indeterminate structures using classical and matrix methods. Use of large-scale computer programs.

CE 561. Introduction to the Finite Element Method. 3 Hours.
Principles and concepts of design in prestressed concrete including elastic limit strength analysis for flexural, shear, bond, and deflections. Principles of concordancy and linear transformation for indeterminate prestressed structures.

CE 562. Advanced Structural Analysis. 3 Hours.
Methods for calculating loads on structures caused by extreme winds and earthquakes. Calculation of wind loads on various types of structures according to theory and codes. Determination of earthquake loads on structures using structural dynamics and codes.

CE 563. Bridge Engineering. 3 Hours.
Bridge loads, steel beam bridges, composite beam bridges, bridge bearings, reinforced and prestressed concrete slab and T-beam bridges, bridge evaluations and ratings, upgrade methodologies; computer applications.
CE 607. Engineering Entrepreneurship. 3 Hours.
Course focuses on the entrepreneurial engineer—a new type of engineer who needs a broad range of business skills and knowledge above and beyond a strong science and engineering background. The course will introduce engineering students to the key aspects of engineering entrepreneurship including business planning, solving problems, risk taking, financing, marketing, and entrepreneurial leadership. The students will also be introduced to the many opportunities and challenges that accompany starting and operating an entrepreneurial venture. Entrepreneurial company leaders will present their experiences and share their leadership styles as part of the course.

CE 608. Green Building Design. 3 Hours.
Quantitative introduction to the principles of "Green Building Design". Provides students an understanding of the interdependencies between economics, technology, design, building occupation and the subsequent impact on the natural environment. Course will emphasize green building materials, new technologies, and sustainable construction methods. Course also includes LEED Case Studies (industrial, commercial, residential, and institutional examples).

CE 610. The Engineered Environment. 3 Hours.
Fundamentals of environmental engineering as they apply to the construction of the built environment and contemporary issues faced by engineers in developing nations such as Egypt. Topics include air pollution, solid waste management, water treatment, environmental ethics, etc.

CE 612. Theory of Elasticity. 3 Hours.
Equations of linear reduction to plane stress, plane strain, and generalized plane strain. Airy and love stress functions in solution of problems.

CE 615. Theory of Elastic Stability. 3 Hours.

CE 617. Theory of Plates and Shells. 3 Hours.

CE 621. Transportation Engineering Seminar. 1 Hour.
Seminar focusing on student research and guest presentations of various topics of interest to graduate transportation engineering students.

CE 622. Traffic Flow Theory. 3 Hours.
Microscopic and macroscopic traffic flow characteristics. Traffic flow analytical techniques including car-following models, traffic stream models, shock wave analysis, queuing analysis and gap acceptance. Simulation models for network analysis.

CE 623. Non-Motorized Transportation Design and Planning. 3 Hours.
Urban planning principles that support non-motorized transportation, local bicycle or pedestrian plans, non-motorized transportation safety related considerations, non-motorized transportation design including traffic calming techniques, procedures for capacity analysis of pedestrian facilities.

CE 624. Simulation Models for Transportation Applications. 3 Hours.
Basic concepts of simulation models for analysis and optimization of transportation systems. Experimentation with planning simulation models and traffic models for signal timing and capacity analysis.

CE 625. Intelligent Transportation Systems. 3 Hours.
Legal, institutional and planning issues related to intelligent transportation systems. System architecture, communication techniques, advanced user services, intermodal systems, connected and autonomous vehicles applications.

CE 631. Environmental Law. 3 Hours.
Law as it applies to the practicing environmental engineer. New and emerging regulations.

CE 632. Industrial Waste and Wastewater Treatment. 3 Hours.
Solid wastes and wastewaters from various industries. Assessment of treatability, system design, and equipment selection.

CE 633. Solid and Hazardous Waste Management. 3 Hours.
Provides students a quantitative introduction to solid and hazardous waste characterizations, international regulations, and management options. Course topics to include (1) Solid waste management hierarchy (reduce, reuse, recycle, recovery, responsible disposal); (2) Dry tomb landfill design; and (3) Hazardous waste identification and treatment/disposal.

CE 636. Stormwater Pollution Management. 3 Hours.
Quality and quantity of stormwater. Receiving water problems and sources of pollutants. Runoff quality and quantity characterizations. Erosion control. Selection and design of controls; regulations.

CE 638. Water and Wastewater Chemistry. 3 Hours.

CE 639. Sediment Sources and Controls. 3 Hours.
Erosion and sediment transport areas; design of common erosion control practices.

CE 640. Wastewater Treatment Engineering. 3 Hours.
Wastewater sources and characteristics. Design and operation of wastewater treatment facilities, including grit removal, oil and grease removal, dissolved air flotation, activated sludge process, trickling filters, and rotating biological contractors, stabilization ponds and aerated lagoons, anaerobic processes for wastewater treatment and sludge digestion. Ultimate disposal of wastewater residues and considerations of discharge criteria.

CE 643. Pavement Design and Construction. 3 Hours.
Design and construction of flexible and rigid pavements. Topics include stress and strain responses, design parameters, AASHTO and NAPA design procedures, pavement construction, pavement rehabilitation, and maintenance techniques.

CE 646. Traffic Engineering Operations. 3 Hours.
Highway and Intersection capacity analysis, traffic signal timing and phasing, coordination, freeway operations, non-signalized traffic control techniques.

CE 648. Urban and Transportation Planning. 3 Hours.
Land use planning for transportation systems; trip generation, trip distribution, and traffic assignment.

CE 649. Engineering Liability. 3 Hours.
Laws related to liability for engineering design in the context of products liability and construction projects; roles and liabilities between various parties involved in construction projects.

CE 650. Advanced Structural Steel. 3 Hours.
Beams, columns, tension members, and connections; current research.

CE 655. Advanced Reinforced Concrete. 3 Hours.
Beam, column, and slab actions; current research.
CE 658. Engineering Management. 3 Hours.
Management techniques for the practicing engineer.

CE 663. Finite Element Methods. 3 Hours.
Theory and applications in structural mechanics. Plane stress, plane strain, axisymmetric problems, solids, plates, shells, nonlinear systems.

CE 681. Chemical Engineering. 3 Hours.
Prerequisites: CE 337 [Min Grade: C]

CE 682. Water Treatment Engineering. 3 Hours.
Water and wastewater treatment processes. Topics include lime softening operations, coagulation, flocculation, clarification, dissolved air flotation, filtration, disinfection, absorption, ion exchange and sludge management.

CE 683. Water and Wastewater Treatment Processes Lab. 3 Hours.
Construction and evaluation of bench-scale treatment processes. Treatability of water and wastewater. Coagulation of sedimentation, settleability of biological sludge, aerobic biological treatment, chemical treatment, water softening toxicity, disinfection, and sludge treatment processes.

CE 685. Engineering Hydrology. 3 Hours.
Hydrologic principles including hydrologic cycle, precipitation data, and stream-flow measurements. Applications to engineering problems; stream-flow analysis and watershed management. A grade of C or better in CE 337 [Hydraulics] or its equivalency is required.

CE 686. Engineering Hydrogeology. 3 Hours.

CE 687. Stormwater Detention Pond Design. 3 Hours.
Stormwater problems and control methods. Urban hydrology prediction procedures for drainage and water quality studies. Detention pond design basics, limitations and multiple benefits.

CE 688. Engineering Hydrology. 3 Hours.
Hydrologic principles including hydrologic cycle, precipitation data, and stream-flow measurements. Applications to engineering problems; stream-flow analysis and watershed management. A grade of C or better in CE 337 [Hydraulics] or its equivalency is required.

CE 689. Building Information Modeling (BIM) Techniques. 3 Hours.
This course provides students with an overview of the evolution of BIM technology in the construction industry followed by hands-on training in the basic application of contemporary BIM software. Students will learn basic modeling skills and how to produce graphical presentations. Advanced applications of BIM technology are discussed and demonstrated. Students will be provided with BIM software and are required to complete a multi-step BIM model as a term project.
Prerequisites: CE 669 [Min Grade: C]

CE 690. Special Topics in (Area). 1-3 Hours.
Special Topics (Area).

CE 691. Individual Study in (Area). 1-4 Hours.
Individual Study (Area).

CE 692. CE Capstone Project. 3 Hours.
This course covers specific contemporary topics related to civil engineering practice and knowledge. Capstone project using case studies to apply skills, knowledge, techniques, and concepts developed in prior courses.

CE 693. Applied Research in CEE. 3-9 Hours.
Research tools, including elements of experimental design and proposal preparation. Effective communication, literature searches, and exploratory data analysis.

CE 695. International Construction Contracts/Liability. 3 Hours.
Provides an overview of the fundamental aspects of the law that affect construction and engineering companies as well as the project owners. Particular emphasis is placed on contract forms and provisions related to liability for engineering design and construction companies, the roles of the typical participation in the process, and dispute resolution.

CE 697. Master's Project. 3-9 Hours.
A UAB Master’s Project must demonstrate evidence of scholarly study and writing that ultimately contributes to the scientific knowledge base. This course is designed to allow students the opportunity to develop original ideas or seek to advance knowledge through theory, conceptualization, design, testing of tools, instruments, or procedures relevant to the practice of civil engineering.


Prerequisites: GAC M

CE 712. Theory of Elasticity. 3 Hours.
Equations of linear reduction to plane stress, plane strain, and generalized plane strain. Airy and love stress functions in solution of problems.

CE 715. Theory of Elastic Stability. 3 Hours.

CE 717. Theory of Plates and Shells. 3 Hours.

CE 721. Transportation Engineering Seminar. 1 Hour.
Seminar focusing on student research and guest presentation of various topics of interest to graduate transportation engineering students.
CE 722. Traffic Flow Theory. 3 Hours.  
Microscopic and macroscopic traffic flow characteristics. Traffic flow analytical techniques including car-following models, traffic stream models, shock wave analysis, queuing analysis and gap acceptance. Simulation models for network analysis.

CE 723. Non-Motorized Transportation Design and Planning. 3 Hours.  
Urban planning principles that support non-motorized transportation, local bicycle or pedestrian plans, non-motorized transportation safety related considerations, non-motorized transportation design including traffic calming techniques, procedures for capacity analysis of pedestrian facilities.

CE 724. Simulation Models for Transportation Applications. 3 Hours.  
Basic concepts of simulation models for analysis and optimization of transportation systems. Experimentation with planning simulation models and traffic models for signal timing and capacity analysis.

CE 725. Intelligent Transportation Systems. 3 Hours.  
Legal, institutional and planning issues related to intelligent transportation systems. System architecture, communication techniques, advanced user services, intermodal systems, connected and autonomous vehicles applications.

CE 731. Environmental Law. 3 Hours.  
Law as it applies to the practicing environmental engineer. New and emerging regulations.

CE 732. Industrial Waste and Wastewater Treatment. 3 Hours.  
Solid wastes and waste waters from various industries; assessment of treatability, system design, and equipment selection.

CE 736. Stormwater Pollution Management. 3 Hours.  
Quality and quantity of stormwater. Receiving water problems and sources of pollutants. Runoff quality and quantity characterizations. Erosion control. Selection and design of controls; regulations.

CE 738. Water and Wastewater Chemistry. 3 Hours.  

CE 739. Sediment Sources and Controls. 3 Hours.  
Erosion and sediment transport in urban areas, design of common erosion control practices.

CE 740. Wastewater Treatment Engineering. 3 Hours.  
Wastewater sources and characteristics. Design and operation of wastewater treatment facilities, including grit removal, oil and grease removal, dissolved air flotation, activated sludge process, trickling filters, and rotating biological contractors, stabilization ponds and aerated lagoons, anaerobic processes for wastewater treatment and sludge digestion. Ultimate disposal of wastewater residues and considerations of discharge criteria.

CE 749. Engineering Liability. 3 Hours.  
Laws related to liability for engineering design in the context of product liability and construction projects; roles and liabilities between various parties involved in construction projects.

CE 750. Advanced Structural Steel. 3 Hours.  
Beams, columns, tension members, and connections; current research.

CE 755. Advanced Reinforced Concrete. 3 Hours.  
Beam, column, and slab actions; current research.

CE 758. Engineering Management. 3 Hours.  
Management techniques for practicing engineers.

CE 763. Finite Element Methods. 3 Hours.  
Theory and applications in structural mechanics. Plane stress, plane strain, axisymmetric problems, solids, plates, shells, nonlinear systems.

CE 781. Environmental Chemistry. 3 Hours.  
Chemical equilibrium, acid/base, chemical concepts in pollutant behavior. Chemical kinetics, redox system, hydrolysis, pesticides, chemical wastes.

CE 782. Water Treatment Engineering. 3 Hours.  
Water sources and characteristics. Design and operation of water treatment facilities including lime softening operations, coagulation, flocculation, clarification, dissolved air flotation, filtration, disinfection, absorption, ion exchange, and sludge disposal.

CE 783. Water and Wastewater Treatment Processes Lab. 3 Hours.  
Construction and evaluation of bench-scale treatment processes. Treatability of water and wastewater. Coagulation of sedimentation, settleability of biological sludge, aerobic biological treatment, chemical treatment, water softening toxicity, disinfection, and sludge treatment processes.

CE 786. Engineering Hydrogeology. 3 Hours.  

CE 787. Stormwater Detention Pond Design. 3 Hours.  
Stormwater problems and control methods. Urban hydrology prediction procedures for drainage and water quality studies. Detention pond design basics, limitations and multiple benefits.

CE 790. Special Topics in (Area). 1-3 Hour.  
Special Topics(In Area).

CE 791. Individual Studies (In Area). 1-4 Hour.  
Individual Studies(In Area).

CE 793. Applied Research in Civil and Environmental Engineering. 3 Hours.  
Research tools, including elements of experimental design and proposal preparation. Effective communication, literature searches, and exploratory data analysis.

CE 797. CCEE Internship. 6 Hours.  
Off-campus internship experience working with industries, utilities or government agencies.

CE 799. Dissertation Research. 1-12 Hour.  
Prerequisites: GAC Z
CECM-Construction Egr Mgmnt Courses

CECM 669. Advanced Project Management. 3 Hours.
Skills generally required for sound project management in a variety of management settings are studied in addition to specific management issues typically associated with engineering and construction companies. Students are introduced to the Project Management Institute's Body of Knowledge (PMBOK). A discussion of corporate organizational structures and the evolving use of project management processes helps establish an appreciation for the role of a Project Manager. The elements of a project and the role and responsibilities of the Project Manager are studied in depth. Students are also acquainted with risk management concepts, financial, labor, safety, equipment, and contracting issues facing managers in the engineering and construction environment. Particular emphasis is placed on individual management strengths and weaknesses, team building, and characteristics of successful companies. One of the primary vehicles for discussion will be small case studies from real companies and the outside reading of one or two relevant topical books.

CECM 670. Construction Estimating and Bidding. 3 Hours.
Provides an overview of typical construction delivery systems and the planning and contracting associated with each. A broad study of estimating methodologies ranging from rough "ball park" estimates to detailed unit pricing is presented focusing on labor, equipment, materials, subcontractors, job conditions, location, overhead, and profit. This course is intended to establish a basic understanding of the estimating process; and therefore, substantial course focus will be placed on the term group project.

CECM 671. Construction Liability & Contracts. 3 Hours.
This course provides an overview of the fundamental aspects of the laws that affect construction and engineering companies as well as the project owners. Particular emphasis is placed on contract forms and provisions related to liability for engineering design and construction companies, the roles of the typical participation in the process, and dispute resolution. Students will learn the importance of contract language negotiations and the impact of project risk transfer.
Prerequisites: CECM 669 [Min Grade: C] or CE 669 [Min Grade: C]

CECM 672. Construction Methods and Equipment. 3 Hours.
This course provides students a big-picture understanding of the construction methods employed to bring the concepts and designs of architects and engineers to physical reality. The International Building Code (IBC) is presented in the course material as are the fundamental principles of green building and sustainable design. Detailed study of typical building materials, design details, and construction methods are presented in a logical sequence. Students will understand the planning and deployment of equipment, materials, labor, and subcontractors using a variety of building material and system types. This course provides a necessary baseline of knowledge, vocabulary, and understanding of the role and activities of the designers, engineers, material suppliers, inspectors, and constructors in the commercial building process.

CECM 673. Project Planning and Control. 3 Hours.
This course provides a thorough understanding of the project scheduling process in construction planning and control. Students learn the relationship between the work breakdown structure, organization breakdown structure, and the activities used in developing project schedules. The Critical Path Method (CPM), Precedence Diagram Method (PDM), Program Evaluation and Review Technique (PERT), and Line of Balance (LOB) scheduling methods are discussed in detail to include hand calculations and powerful computer software products. The use of scheduling techniques for project control, resources constraint management, cash flow management, risk management, and project completion date management are investigated as is the importance of communications in the planning and monitoring/controlling processes. Students will experience hands-on use with Primavera scheduling software.

CECM 674. Green Building Design/Construction. 3 Hours.
This course provides an introduction to the emerging trends in green building sustainable design and construction. The course will include instruction suitable to prepare students for the United States Green Building Council (USGBC) Leadership in Energy and Environmental Design (LEED©) Green Associates certification exam.

CECM 675. Advanced Construction and Engineering Economics. 3 Hours.
This course provides an extensive overview of financial and managerial accounting concepts for non-financial managers. Students will learn the basic elements of accounting (Generally Accepted Accounting Practices (GAAP)). They will understand how typical financial records and financial statements are established for companies. Once the basics are understood, students will study how financial data is used for internal cost controlling, planning, and budgeting. Fundamental financial calculations associated with the time value of money, debt instruments, taxes, inflation, and cash flow estimates are emphasized. Students will be expected to demonstrate proficiency in the use of Excel business functions in solving financial problems.

CECM 676. Construction Project Risk Management. 3 Hours.
This course addresses the methodologies employed in the engineering and construction industries to assist in rational decision-making in the face of uncertainty. The course reviews the fundamentals of common probabilistic theories and models, data sampling, hypothesis testing and the basics of Bayesian Decision Theory. In addition, basic financial analysis tools will be reviewed. Theoretical models will then be applied to specific examples encountered in engineering and construction decision making with emphasis on engineering economics applications.
CECM 688. Construction Management and Leadership Challenges in the Global Environment. 3 Hours.
This course is designed to prepare students to face the demanding management and leadership challenges facing construction and engineering industry leaders as competition becomes ever more globalized. The necessity to personally remain trained and relevant in the changing business environment is emphasized. Strong resume writing and oral interview skills are emphasized as a necessary skill for job seekers as well as job providers. Strategic planning, management and leadership in the built environment requires savvy leaders with exceptionally developed analytical and communications skills suitable for multi-disciplinary and multi-national ventures. Every individual and organization must continually innovate and reinvent to stay competitive. Students participate in a group project designed to reinforce the methodology associated with preparing and presenting a dynamic business plan. This course will provide the opportunity for students to discuss and research these concepts and to recognize the necessity to think independently, challenge conventional thinking, and visualize alternatives.
Prerequisites: CECM 670 [Min Grade: C] and CECM 675 [Min Grade: C]

CECM 689. Building Information Modeling (BIM) Techniques. 3 Hours.
This course provides students with an overview of the evolution of BIM technology in the construction industry followed by hands-on training in the basic application of contemporary BIM software. Students will learn basic modeling skills and how to produce graphical presentations. Advanced applications of BIM technology will be discussed and demonstrated. Students will be provided with BIM software and will be required to complete a multi-step BIM model as a term project.

CESC-Sustainable Smart Cities Courses

CESC 600. Principles of Sustainable Development. 3 Hours.
The course will begin by discussing the concepts, viewpoints and fundamentals essential for understanding urban sustainable development agenda. This will be followed by the evaluation of international conferences and action items proposed by the scientific/professional community to advance sustainable smart cities development. You will review basic earth sciences to better evaluate the impact our anthropogenic activities have on the natural environment and therefore how to minimize adverse future outcomes. Throughout the course case studies of sustainable developments will be used to illustrate the value, challenges and limitations of this concept. In the end, you will possess the knowledge base needed to help advance sustainable smart cities development.

CESC 602. Introduction to Sustainable Smart Cities. 3 Hours.
This course introduces the issues surrounding sustainable development within cities and explores how the smart city concept can contribute to the urban sustainable development agenda. The course begins by considering the key characteristics of contemporary urbanization and the issues and challenges that these present for sustainability and urban environmental management. The meaning and nature of sustainability for cities will be discussed, followed by a consideration of the definitions of a smart city and a discussion of the key elements of a smart city including its contribution to both urban governance and the more effective and efficient management of natural resources. With reference to case studies the final part of the course will explore and evaluate the role that smart city processes and applications can play in enhancing the social, economic and environmental aspects of sustainable development within urban areas.

CESC 604. Low-Carbon and Renewable Energy Systems for Smart Cities. 3 Hours.
As the energy infrastructure is arguably the most important feature in any city energy efficiency and integration of renewable energy sources within urban areas are central to the smart city concept. This course will firstly explore why there is a need for the greater use of low carbon and renewable energy systems within cities, followed by an introduction to the range of low carbon and renewable energy technologies currently available. The course will then move on to introduce the concept of the smart grid and then explore the potential to integrate low carbon and renewable energy systems into smart grids in order to move towards cost-effective, efficient and more environmentally friendly energy provision within cities. Challenges and issues associated with the greater integration of low carbon and renewable energy systems into energy infrastructure within large urban areas will also be considered.

CESC 606. Managing Natural Resources and Sustainable Smart Cities. 3 Hours.
The course examines the challenges of resource use and management within the context of an urbanizing world, exploring how new concepts within the smart and sustainable city agenda may contribute to addressing these challenges. The course begins by considering contemporary patterns of resource use created by cities in the modern world at a variety of scales from the local to the global. New approaches in the form of ecosystem services and urban metabolism in relation to natural resource management are examined in terms of their contribution to developing a smart and sustainable city agenda. The course continues by exploring a selection of key natural resources challenges (e.g. water, energy, air quality and climate) and the development of new management approaches and strategies in these areas. The course concludes by examining the development of integrated environmental management systems and governance structures within which these new approaches can be implemented with reference to a series of case studies.

CESC 608. Green Infrastructure and Transportation. 3 Hours.
The course covers policy and technical issues related to sustainable transportation. The course begins by discussing the concepts, viewpoints and fundamentals essential for understanding sustainable transportation planning. Tools used to assess sustainability of transportation facilities and neighborhoods are introduced next. The course also presents design options in support of green infrastructure and transportation, including livable street design, and traffic calming applications. The course is expected to expand students' knowledge base on sustainable transportation issues and help them understand the concept of sustainable transportation toward the development of sustainable smart cities.

CESC 610. Health and Liveability. 3 Hours.
This course will address the multidisciplinary aspects of urban environmental quality and its impact on human well-being. It will provide a critical appreciation of the factors which influence health, well-being and quality of life within contemporary urban environments, demonstrate the importance of genomics and health informatics in developing strategies for improving the health and well-being of urban citizens, explore the importance of urban design and the contribution of the development of food smart cities in improving both urban health and liveability, and understand the increasingly important role of ICT in facilitating delivery of effective and responsive urban health, well-being and quality of life strategies.
CESC 612. Green Buildings. 3 Hours.
The course will begin by discussing the concepts, viewpoints and fundamentals essential for understanding green building and construction. Discussions will then be focused on how key stakeholders and their future collaborations can begin to incorporate sustainable construction practices for the betterment of the project (new construction and inventory rehabilitation). This will be followed by the evaluation of sustainable construction rating systems (LEED, BREEAM, etc.) and how they can be applied to occupied buildings throughout an urban environment. Modular case studies of sustainable construction projects (individual structures to entire community developments) will be used to illustrate the value, challenges and limitations of this concept. In the end, students will possess an expanded knowledge base needed to help advance sustainable smart cities development.

CESC 614. Smart Cities Technologies. 3 Hours.
Smart Technologies.

CESC 616. Big Data and Smart Cities. 3 Hours.
The world is becoming increasingly digitally interconnected and this instrumentation, data collection, interconnection, storage, and analysis can provide the capacity to radically transform how cities monitor, manage and enhance their environmental quality and liveability. This course will provide an introduction to what big data is and how it can contribute to the smarter, more sustainable management of cities. The course will begin by discussing the concepts of big data and the big data revolution, and an overview of the ways in which data can be captured, stored and analyzed. This will be followed by a consideration of how big data can be used by city managers to optimize: their use of physical and digital infrastructures; their sustainable use of natural resources; citizen service delivery; and citizen engagement, participation and urban governance. You will also be introduced to some of the challenges presented by big data, both the technological challenges and the ethical and social implications associated with collecting, storing and using big data. Throughout the course case studies of big data in action will be used to illustrate the value, challenges and limitations of big data in the smarter, more sustainable management of cities.

CESC 618. Research Methods and Project Planning. 3 Hours.
As a student of smart city processes and urban environmental management you need to understand the research process which enables you to take the knowledge and skills which you have learned and apply it to a specific urban sustainability / environmental management issue. This course is not intended to provide a training in research techniques, but rather to make you aware of a wide range of investigative and analytical methods and techniques using examples drawn from the areas of smart city approaches, urban sustainability and environmental management. Both quantitative and qualitative methodologies and primary and secondary data collection will be covered. You will be encouraged to reflect on the research process and its outcomes by critiquing research papers written from methodological standpoints. You will then apply this knowledge to create a viable research proposal for your own Sustainable Smart Cities Masters project. This proposal will require you to identify and justify for your chosen topic: (i) appropriate research questions, (ii) methodologies and data sampling / collection techniques, (iii) ethical and health and safety implications and, (iv) a timetable of action.

CESC 620. Sustainable Smart Cities Research Project. 0 Hours.
This course will develop skills in both research and technical writing in the area of applying and/or evaluating sustainable smart cities processes and policies to a specific urban environmental or sustainability issue. The research proposal produced as part of the Research Methods and Project Planning course will be implemented. This will involve further research into the relevant background and context of a chosen project topic, implementation and evaluation of appropriate methods for collecting and analyzing data, observations and information, the ability to present findings clearly and concisely, and appreciate their significance in relation to the smart city and sustainable urban management agendas. Research should be at the forefront of student’s chosen sustainable smart cities research topic and be at a level similar to that required for acceptance and presentation at a national level conference or symposium on smart and sustainable cities. For students in relevant employment, projects may be carried out in your place of work subject to discussions between you, your employer/line manager, and your project supervisor.

CESE - Structural Engineering Courses

CESE 653. Wood and Masonry Design. 3 Hours.
Design of wood structures to meet the requirements of the National Design Specification including beams, columns, and shear walls. Design and detailing of masonry structures. Nomenclature, properties, and specifications for components. Design of assemblages and masonry elements in simple masonry structures.

CESE 656. Advanced Mechanics of Materials for Structural Engineering. 3 Hours.
This course will review the basic fundamentals of mechanics of materials and will extend the concepts to include 3 dimensional stress and strain, plastic behavior, energy methods, nonlinear behavior, fatigue and fracture, rectangular linear elastic plates, indeterminate structures and stability.

CESE 657. Advanced Design of Steel Structures. 3 Hours.
Design of major components in steel-framed buildings, including composite beams and slabs, beam-columns, moments connections, bracing members, bracing connections, and column base plates.

CESE 659. Advanced Reinforced Concrete. 3 Hours.
In this course students will study the behavior and design of continuous reinforced concrete structures submitted to gravity and lateral loads. The study will include biaxial loading of columns, continuous one-way beams and slabs two-way floor systems, and torsion loading.

CESE 660. Prestressed Concrete Behavior and Design. 3 Hours.
The course will explore the characteristics and design of pre-stressed concrete structural components to include elastic and ultimate strength analyses for flexural, shear, torsion, deflection, strand bond, and pre-stress loss.

CESE 662. Advanced Structural Analysis. 3 Hours.
This course explores the structural analysis of indeterminate structures using classical and approximate methods and structural analysis software. Specific emphasis is placed on the determination of forces in typical multistory, rectilinear frames subject to gravity and lateral loads. In addition to first order analysis, the course included analysis for second order effects and plastic analysis.

CESE 664. Bridge Engineering. 3 Hours.
This course includes the study of bridge loads, including moving load analysis; methods for approximate structural analysis, preliminary bridge design methods, and the structural design of bridge decks and girders.
CESE 665. Structural Dynamics and Earthquake Engineering. 3 Hours.
This course includes the study of earthquake-induced vibrations of single and multi-degree-of-freedom systems, such as single and multistory frames. Emphasis will be placed on structural steel and reinforced concrete building frames. Response spectrum analysis will be investigated as well as building codes and static and dynamic lateral load force procedures.

CESE 676. Design of Structural Steel Connections. 3 Hours.
Design of bolted and welded steel connections, including shear, moment and brace connections using the AISC Specifications requirements and fundamental engineering principals. Design procedures will be discussed for various structural steel connections. The background and limitations of the design procedures will be reviewed and practical solutions will be provided.

CESE 690. Special Topics (Area). 1-3 Hour.
Special Topics (Area).

CESE 698. Non Thesis Research. 3 Hours.
No syllabus for non-thesis research hours.