# CONSTRUCTION ENGINEERING

**Administered by the Department of Civil, Construction and Environmental Engineering**

The curriculum in construction engineering, leading to a bachelor of science degree can be referenced here: http://catalog.iastate.edu/collegeofengineering/constructionengineering/#curriculumtext (http://catalog.iastate.edu/previouscatalogs/2020-2021/collegeofengineering/constructionengineering/#curriculumtext). The Construction Engineering program is accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org.

Program educational objectives: By three to five years after graduation, graduates of the construction engineering program will have:

1. Pursued successful careers and expertise in construction engineering or a related profession.
2. Collaborated effectively on multi-disciplinary teams to address the needs of society and the environment.
3. Pursued lifelong learning, professional development, and licensure as appropriate for their career goals.

Students who successfully complete the curriculum will be prepared for entry into the field or for further study at the graduate level in construction engineering or related fields of study, such as law, business and other engineering disciplines.

Construction engineers need to possess a strong fundamental knowledge of engineering design and management principles, including knowledge of business procedures, economics, and human behavior. Graduates of this curriculum may expect to engage in design of temporary structures, coordination of project design, systems design, cost estimating, planning and scheduling, company and project management, materials procurement, equipment selection, and cost control. With the emergence of integrated project delivery methods such as design-build construction, the role of the construction engineer is expanding the need for trained professionals that understand both aspects of the project delivery environment. The curriculum offers opportunities to study emphases concerned with building, heavy, mechanical, or electrical construction. The process of construction involves the organization, administration, and coordination of labor resource requirements, temporary and permanent materials, equipment, supplies and utilities, money, technology and methods. These must be integrated in the most efficient manner possible to complete construction projects on schedule, within the budget, and according to the standards of quality and performance specified by the project owner or designer. The curriculum blends engineering, management and business sciences into a study of the processes of construction whereby designer's plans and specifications are converted into physical structures and facilities.

The curriculum develops the ability of students to be team workers, creative thinkers, and effective communicators. This is achieved by encouraging students to:

- interact with practicing professionals
- gain work experience during summer jobs, internship, and cooperative education assignments that emphasize the knowledge required of construction engineers
- develop leadership skills by participating in student organizations
- develop, analyze, and interpret alternative solutions to open-ended problems
- study abroad

The construction industry is becoming increasingly global. Courses in humanities, social sciences, U.S. diversity, and international perspectives are included in the curriculum to broaden the student's perspective of the work environment. In addition, the department has several exchange program opportunities for students to participate in study abroad programs.

Qualified construction engineering students within 30 credits of completing their degree may apply for concurrent enrollment in the Graduate College. See Civil Engineering (http://www.ccee.iastate.edu/academics/graduate/) Graduate Study for more information.

## Curriculum in Construction Engineering

Administered by the Department of Civil, Construction and Environmental Engineering; leading to the degree bachelor of science.

**Total credits required: Building Option -128.0, Heavy Option - 127.0, Electrical - 127.0, Mechanical - 127.0 cr.**

The Construction Engineering program requires a grade of a C or better for any transfer credit course that is applied to the degree program (but will not be calculated into the ISU cumulative GPA, Basic Program GPA or Core GPA). Note: Department does not allow Pass/Not Pass credits to be used to meet graduation requirements for either required or elective courses.

**International Perspectives: 3 cr.** [1]
**U.S. Diversity: 3 cr.** [1]
**Communication Proficiency/Library requirements:**

| | | |
|---|---|---|
| ENGL 150 | Critical Thinking and Communication (Must have a C or better in this course) | 3 |
| ENGL 250 | Written, Oral, Visual, and Electronic Composition (Must have a C or better in this course) | 3 |
| LIB 160 | Information Literacy | 1 |
| Business Communication Elective: one course of the following with a minimum grade of C. | | 3 |

| | | |
|---|---|---|
| ENGL 302 | Business Communication | |
| ENGL 309 | Proposal and Report Writing | |
| ENGL 314 | Technical Communication | |
| **Total Credits** | | **10** |

**Social Sciences and Humanities: 12 cr.**

| | | |
|---|---|---|
| One of the following | | 3 |
| PSYCH 101 | Introduction to Psychology | |
| PSYCH 230 | Developmental Psychology | |
| PSYCH 250 | Psychology of the Workplace | |
| PSYCH 280 | Social Psychology | |
| SOC 134 | Introduction to Sociology | |
| ECON 101 | Principles of Microeconomics | 3 |
| or ECON 102 | Principles of Macroeconomics | |
| International Perspectives [1] | | 3 |
| U.S. Diversity [1] | | 3 |
| **Total Credits** | | **12** |

**Basic Program: 24 cr. [3]**

Minimum GPA of 2.00 required for this set of courses to graduate, (please note that transfer course grades will not be calculated into the Basic Program GPA).[3]

| | | |
|---|---|---|
| CHEM 167 | General Chemistry for Engineering Students | 4 |
| or CHEM 177 | General Chemistry I | |
| ENGL 150 | Critical Thinking and Communication (Must have a C or better in this course) | 3 |
| ENGR 101 | Engineering Orientation | R |
| C E 160 | Engineering Problems with Computational Laboratory [3] | 3 |
| LIB 160 | Information Literacy | 1 |
| MATH 165 | Calculus I | 4 |
| MATH 166 | Calculus II | 4 |
| PHYS 221 | Introduction to Classical Physics I | 5 |
| **Total Credits** | | **24** |

**Math and Physical Science: 12 cr.**

| | | |
|---|---|---|
| STAT 305 | Engineering Statistics | 3 |
| or STAT 231 | Probability and Statistical Inference for Engineers | |
| MATH 267 | Elementary Differential Equations and Laplace Transforms | 4 |
| PHYS 222 | Introduction to Classical Physics II | 5 |
| **Total Credits** | | **12** |

**Construction Engineering Core: 27 cr. (B, H); 28 cr. (E, M). Minimum 2.00 GPA for this set of courses to graduate (please note that transfer course grades will not be calculated into the Core GPA):**

| | | |
|---|---|---|
| C E 274 | Engineering Statics | 3 |
| E M 324 | Mechanics of Materials | 3 |
| CON E 422 | Construction Cost Estimating and Cost Engineering | 3 |
| CON E 441 | Construction Planning, Scheduling, and Control | 3 |
| E M 378 | Mechanics of Fluids | 3 |
| C E 332 | Structural Analysis I | 3 |
| See options for remaining core courses | | 9-10 |
| **Total Credits** | | **27-28** |

Select remaining courses from one of the following options:

**Building Option: Remaining Core courses 10 cr.**

| | | |
|---|---|---|
| C E 360 | Geotechnical Engineering | 4 |
| CON E 322 | Construction Equipment and Heavy Construction Methods | 3 |
| CON E 340 | Concrete and Steel Construction | 3 |
| **Total Credits** | | **10** |

**Building Option: Remaining courses 17 cr.**

| | | |
|---|---|---|
| C E 333 | Structural Steel Design I | 3 |
| C E 334 | Reinforced Concrete Design I | 3 |
| C E 383 | Design of Portland Cement Concrete | 1 |
| CON E 352 | Mechanical Systems in Buildings | 3 |
| CON E 353 | Electrical Systems in Buildings | 3 |
| E M 327 | Mechanics of Materials Laboratory | 1 |
| Engineering Topics Elective [2] | | 3 |
| **Total Credits** | | **17** |

**Heavy Option: Remaining Core courses 10 cr.**

| | | |
|---|---|---|
| C E 360 | Geotechnical Engineering | 4 |
| CON E 322 | Construction Equipment and Heavy Construction Methods | 3 |
| CON E 340 | Concrete and Steel Construction | 3 |
| **Total Credits** | | **10** |

**Heavy Option: Remaining courses 16 cr.**

| | | |
|---|---|---|
| C E 333 | Structural Steel Design I | 3 |
| C E 334 | Reinforced Concrete Design I | 3 |
| C E 382 | Design of Concretes | 3 |
| E M 327 | Mechanics of Materials Laboratory | 1 |
| Engineering Topics Electives [2] | | 6 |
| **Total Credits** | | **16** |

**Electrical Option: Remaining Core courses 10 cr.**

| | | |
|---|---|---|
| E E 230 | Electronic Circuits and Systems | 4 |
| E E 303 | Energy Systems and Power Electronics | 3 |
| E E 456 | Power System Analysis I | 3 |
| **Total Credits** | | **10** |

**Electrical Option: Remaining courses 16 cr.**

| | | |
|---|---|---|
| CON E 352 | Mechanical Systems in Buildings | 3 |
| CON E 353 | Electrical Systems in Buildings | 3 |
| E E 201 | Electric Circuits | 4 |
| E E 457 | Power System Analysis II | 3 |
| Engineering Topics Elective [2] | | 3 |
| **Total Credits** | | **16** |

**Mechanical Option: Remaining Core courses 10 cr.**

| | | |
|---|---|---|
| M E 231 | Engineering Thermodynamics I | 3 |
| M E 436 | Heat Transfer | 4 |
| M E 441 | Fundamentals of Heating, Ventilating, and Air Conditioning | 3 |
| **Total Credits** | | **10** |

**Mechanical Option: Remaining courses 16 cr.**

| | | |
|---|---|---|
| CON E 352 | Mechanical Systems in Buildings | 3 |
| CON E 353 | Electrical Systems in Buildings | 3 |
| E E 442 | Introduction to Circuits and Instruments | 2 |
| E E 448 | Introduction to AC Circuits and Motors | 2 |
| M E 442 | Heating and Air Conditioning Design | 3 |
| Engineering Topics Elective [2] | | 3 |
| **Total Credits** | | **16** |

**Additional Required Courses: 35 cr.**

| | | |
|---|---|---|
| CON E 121 | Cornerstone Learning Community: Orientation to Academic Life | 1 |
| CON E 122 | Cornerstone Learning Community: Orientation to Professional Life | 1 |
| C E 170 | Graphics for Civil Engineering | 2 |
| C E 111 | Fundamentals of Surveying I | 3 |
| CON E 222 | Contractor Organization and Management of Construction | 3 |
| I E 305 | Engineering Economic Analysis | 3 |
| CON E 241 | Construction Materials and Methods | 3 |
| CON E 251 | Mechanical/Electrical Materials and Methods | 1 |
| ENGL 250 | Written, Oral, Visual, and Electronic Composition (Must have a C or better in this course) | 3 |
| Law Elective | | 3 |
| CON E 380 | Engineering Law | |
| ACCT 215 | Legal Environment of Business | |
| CON E 487 | Construction Engineering Design I | 3 |
| CON E 488 | Construction Engineering Design II | 3 |
| Business Communication Elective (minimum grade of C) | | 3 |
| ENGL 302 | Business Communication | |
| ENGL 309 | Proposal and Report Writing | |
| ENGL 314 | Technical Communication | |
| Complete one course from Math or Stat Elective [2] | | 3 |
| **Total Credits** | | **35** |

**Co-op/Internships - Optional**

1. These university requirements will add to the minimum credits of the program unless the university-approved courses are also approved by the department to meet other course requirements within the degree program. U.S. diversity and international perspectives courses may not be taken Pass/Not Pass.
2. Choose from department approved list (http://www.ccee.iastate.edu/academics/advising/construction-engineering-student-forms/).
3. See Basic Program for Engineering Curricula (http://catalog.iastate.edu/previouscatalogs/2020-2021/collegeofengineering/#basicprogramcurriculatext) for accepted substitutions for curriculum designated courses in the Basic Program https://www.engineering.iastate.edu/classification/students/basic-program/

See also: A 4-year plan of study grid showing course template by semester for a building emphasis in Construction Engineering. (http://catalog.iastate.edu/previouscatalogs/2020-2021/collegeofengineering/constructionengineering/#curriculumtext)

See also: A 4-year plan of study grid showing course template by semester for an electrical emphasis in Construction Engineering. (http://catalog.iastate.edu/previouscatalogs/2020-2021/collegeofengineering/constructionengineering/#fouryearplanselectricalemphasistext)

See also: A 4-year plan of study grid showing course template by semester for a heavy/highway emphasis in Construction Engineering. (http://catalog.iastate.edu/previouscatalogs/2020-2021/collegeofengineering/constructionengineering/#fouryearplantext/#Heavy)

See also: A 4-year plan of study grid showing course template by semester for a mechanical emphasis in Construction Engineering. (http://catalog.iastate.edu/previouscatalogs/2020-2021/collegeofengineering/constructionengineering/#fouryearplanmechanicalemphasistext)

Construction Engineering, B.S. building emphasis

**First Year**

| Fall | Credits | Spring | Credits |
|---|---|---|---|
| CON E 121 | 1 | CON E 122 | 1 |
| C E 160 | 3 | C E 170 | 2 |
| MATH 165 | 4 | MATH 166 | 4 |
| CHEM 167 | 4 | PHYS 221 | 5 |
| ENGL 150 | 3 | ENGL 250 | 3 |
| ENGR 101 | R | LIB 160 | 1 |
| | **15** | | **16** |

**Second Year**

| Fall | Credits | Spring | Credits |
|---|---|---|---|
| CON E 222 | 3 | CON E 241 | 3 |
| C E 111 | 3 | CON E 251 | 1 |
| Math or Stat Elective | 3 | MATH 267 | 4 |
| PHYS 222 | 5 | C E 274 | 3 |
| SSH Elective (Econ 101 or 102) | 3 | I E 305 | 3 |
| | **17** | | **14** |

**Third Year**

| Fall | Credits | Spring | Credits |
|---|---|---|---|
| CON E 352 | 3 | CON E 340 | 3 |
| CON E 353 | 3 | CON E 322 | 3 |
| STAT 231 or 305 | 3-4 | Law Elective (ConE 380 or Acct 215) | 3 |
| E M 324 | 3 | C E 360 | 4 |
| E M 378 | 3 | C E 332 | 3 |
| SSH Elective (Psych 101/230/250/280 or Soc 134) | 3 | E M 327 | 1 |
| | **18-19** | | **17** |

**Fourth Year**

| Fall | Credits | Spring | Credits |
|---|---|---|---|
| CON E 422 | 3 | CON E 487 | 3 |
| CON E 441 | 3 | CON E 488 | 3 |
| C E 383 | 1 | Business Comm Elective (ENGL 302 or 309 or 314) | 3 |
| C E 333 | 3 | C E 334 | 3 |
| Engr Topics Elective | 3 | SSH Elective (International Perspective) | 3 |
| SSH Elective (US Diversity) | 3 | | |
| | **16** | | **15** |

Construction Engineering, B.S. electrical emphasis

**First Year**

| Fall | Credits | Spring | Credits |
|---|---|---|---|
| CON E 121 | 1 | CON E 122 | 1 |
| C E 160 | 3 | C E 170 | 2 |
| MATH 165 | 4 | MATH 166 | 4 |
| CHEM 167 | 4 | PHYS 221 | 5 |
| ENGL 150 | 3 | ENGL 250 | 3 |
| ENGR 101 | R | LIB 160 | 1 |
| | **15** | | **16** |

**Second Year**

| Fall | Credits | Spring | Credits |
|---|---|---|---|
| CON E 222 | 3 | CON E 241 | 3 |
| C E 111 | 3 | CON E 251 | 1 |
| MATH or STAT Elective | 3 | MATH 267 | 4 |
| PHYS 222 | 5 | C E 274 | 3 |
| SSH Elective (Econ 101 or 102) | 3 | I E 305 | 3 |
| | **17** | | **14** |

**Third Year**

| Fall | Credits | Spring | Credits |
|---|---|---|---|
| CON E 352 | 3 | Law Elective (ConE 380 or Acct 215) | 3 |
| CON E 353 | 3 | E E 230 | 4 |
| STAT 231 or 305 | 3-4 | E E 303 | 3 |
| E M 324 | 3 | E M 378 | 3 |
| E E 201 | 4 | SSH Elective (Psych 101/230/250/280 Soc 134) | 3 |
| | **16-17** | | **16** |

**Fourth Year**

| Fall | Credits | Spring | Credits |
|---|---|---|---|
| CON E 422 | 3 | CON E 487 | 3 |
| CON E 441 | 3 | CON E 488 | 3 |
| E E 456 | 3 | E E 457 | 3 |
| C E 332 | 3 | Business Comm Elective (ENGL 302 or 309 or 314) | 3 |
| Engineering Topics Elective | 3 | SSH Elective (International Perspective) | 3 |
| SSH Elective (US Diversity) | 3 | | |
| | **18** | | **15** |

Construction Engineering, B.S. heavy/highway emphasis

**First Year**

| Fall | Credits | Spring | Credits |
|---|---|---|---|
| CON E 121 | 1 | CON E 122 | 1 |
| C E 160 | 3 | C E 170 | 2 |
| MATH 165 | 4 | MATH 166 | 4 |
| CHEM 167 | 4 | PHYS 221 | 5 |
| ENGL 150 | 3 | ENGL 250 | 3 |
| ENGR 101 | R | LIB 160 | 1 |
| | **15** | | **16** |

**Second Year**

| Fall | Credits | Spring | Credits |
|---|---|---|---|
| CON E 222 | 3 | CON E 241 | 3 |
| C E 111 | 3 | CON E 251 | 1 |
| Math or Stat Elective | 3 | MATH 267 | 4 |
| PHYS 222 | 5 | C E 274 | 3 |
| SSH Elective (Econ 101 or 102) | 3 | I E 305 | 3 |
| | **17** | | **14** |

**Third Year**

| Fall | Credits | Spring | Credits |
|---|---|---|---|
| CON E 322 | 3 | CON E 340 | 3 |
| Law Elective (ConE 380 or Acct 215) | 3 | CON E 422 | 3 |
| STAT 231 or 305 | 3-4 | C E 360 | 4 |
| E M 324 | 3 | C E 332 | 3 |
| E M 378 | 3 | E M 327 | 1 |
| SSH Elective (Psych 101/230/250/280 Soc 134) | 3 | SSH Elective (US Diversity) | 3 |
| | **18-19** | | **17** |

**Fourth Year**

| Fall | Credits | Spring | Credits |
|---|---|---|---|
| CON E 441 | 3 | CON E 487 | 3 |
| Engineering Topics Elective | 3 | CON E 488 | 3 |
| C E 382 | 3 | Engineering Topics Elective | 3 |
| C E 333 | 3 | C E 334 | 3 |
| SSH Elective (International Perspective) | 3 | Business Comm Elective (ENGL 302 or 309 or 314) | 3 |
| | **15** | | **15** |

Construction Engineering, B.S. mechanical emphasis

**First Year**

| Fall | Credits | Spring | Credits |
|---|---|---|---|
| CON E 121 | 1 | CON E 122 | 1 |
| C E 160 | 3 | C E 170 | 2 |
| MATH 165 | 4 | MATH 166 | 4 |
| CHEM 167 | 4 | PHYS 221 | 5 |
| ENGL 150 | 3 | ENGL 250 | 3 |
| ENGR 101 | R | LIB 160 | 1 |
| | **15** | | **16** |

**Second Year**

| Fall | Credits | Spring | Credits |
|---|---|---|---|
| CON E 222 | 3 | CON E 241 | 3 |
| C E 111 | 3 | CON E 251 | 1 |
| Math/Stat Elective | 3 | MATH 267 | 4 |
| PHYS 222 | 5 | C E 274 | 3 |
| SSH Elective (Econ 101 or 102) | 3 | I E 305 | 3 |
| | **17** | | **14** |

**Third Year**

| Fall | Credits | Spring | Credits |
|---|---|---|---|
| CON E 352 | 3 | Law Elective (ConE 380 or Acct 215) | 3 |
| CON E 353 | 3 | E E 442 | 2 |
| STAT 231 or 305 | 3-4 | E E 448 | 2 |
| E M 324 | 3 | C E 332 | 3 |
| M E 231 | 3 | E M 378 | 3 |
| SSH Elective (Psych 101/230/250/280 Soc 134) | 3 | SSH Elective (US Diversity) | 3 |
| | **18-19** | | **16** |

**Fourth Year**

| Fall | Credits | Spring | Credits |
|---|---|---|---|
| CON E 422 | 3 | CON E 487 | 3 |
| CON E 441 | 3 | CON E 488 | 3 |
| M E 436 | 4 | M E 442 | 3 |
| M E 441 | 3 | Business Comm Elective (ENGL 302 or 309 or 314) | 3 |
| Engineering Topics Elective | 3 | SSH Elective (International Perspective) | 3 |
| | **16** | | **15** |

# Graduate Study

An area of specialization in construction engineering and management is offered within the graduate program of the Department of Civil,

Construction and Environmental Engineering. This specialization focuses on project management including and beyond the traditional iron triangle of scope, technical, and schedule to include context and financing, enabling project management of more complex projects. Three graduate degrees including, Master of Engineering (30 credits), Master of Science (30 credits), and Doctor of Philosophy (72 credits) are offered. The Master of Engineering degree is a coursework only option and the other degree programs require a research component at a level adjusted to the degree sought. All degrees are offered on-campus and some degrees may be completed off-campus through distance education. All degrees require C E 501, C E 502, C E 503, and six to nine credits additional credits. Course options include but are not limited to:

| | | |
|---|---|---|
| C E 501 | Preconstruction Project Engineering and Management | 3 |
| C E 502 | Construction Project Engineering and Management | 3 |
| C E 503 | Construction Finance and Business Management | 3 |
| C E 505 | Design of Construction Systems | 3 |
| C E 594A | Special Topics Construction Engineering and Mgt.: Planning and Scheduling | 3 |
| C E 594L | Spl Topics Construction Engr and Mgt.: Adv Building Construction Topics - LEED for New Construction | 3 |
| C E 594N | Special Topics Construction Engineering and Mgt.: Industrial Construction | 3 |
| C E 594O | Special Topics Construction Engineering and Mgt.: Highway and Heavy Construction | 3 |
| C E 594P | Special Topics Construction Engineering and Mgt.: Advanced Building Energy Systems and Technologies | 3 |

Undergraduate students may also qualify for the concurrent bachelor of science/master of science (BS/MS) degree program. Courses are offered for minor work to students taking major work in other curricula or in interdepartmental programs. A graduate certificate is also available which requires 12 credits of coursework. Courses required for the certificate are C E 501, C E 502, and C E 503. For additional information see Civil Engineering, Graduate Programs, https://www.ccee.iastate.edu/academics/graduate/.

**Courses primarily for undergraduates:**

**CON E 121: Cornerstone Learning Community: Orientation to Academic Life**

(0-2) Cr. 1. F.

Integration of first-year and transfer students into the engineering profession and the Construction Engineering program. Assignments and activities completed both individually and in learning teams involving teamwork, academic preparation, and study skills. Introduction to construction industry professionals. Teamwork topics include interdisciplinary teamwork, skills for academic success, diversity issues and leadership. Introduction to organization of program, department, college, and university. Overview of faculty, staff, policies, procedures and resources.

**CON E 122: Cornerstone Learning Community: Orientation to Professional Life**

(0-2) Cr. 1. S.

Continuation of Con E 121. Integration of first-year and transfer students into the engineering profession. Career preparation, professional ethics, construction research, leadership. Introduction to construction industry professionals including how they interact with engineers in other disciplines. Continued introduction to program, department, college, and university organization. Overview of faculty, staff, policies, procedures and resources.

**CON E 222: Contractor Organization and Management of Construction**

(2-2) Cr. 3. F.S.

*Prereq: Completion of basic program within current semester.*

Entry level course for construction engineering: integration of significant engineering and management issues related to construction company operations. Company organization and operations; construction and project administration; construction contracts; project delivery systems; quality management; construction safety; contract and project documents.

**CON E 241: Construction Materials and Methods**

(2-3) Cr. 3. F.S.

*Prereq: Completion of basic program*

Introduction to materials and methods of building construction and to construction drawings. Foundation, structural framing, floor, roof, and wall systems. Blueprint reading and quantity takeoff techniques.

**CON E 251: Mechanical/Electrical Materials and Methods**

(0-3) Cr. 1. F.S.

*Prereq: Credit or enrollment in CON E 241*

Introduction to the materials and methods for mechanical and electrical construction systems and drawings. HVAC, water and waste water, power distribution, lighting, and fire protection. Blueprint reading and quantity takeoff.

**CON E 322: Construction Equipment and Heavy Construction Methods**
(2-2) Cr. 3. F.S.
*Prereq: CON E 222 and CON E 241, or C E 306 in lieu of CON E 222 and 241*
Selection and acquisition of construction equipment. Application of engineering fundamentals and economics to performance characteristics and production of equipment. Heavy construction methods and economic applications.

**CON E 340: Concrete and Steel Construction**
(2-2) Cr. 3. F.S.
*Prereq: E M 324 and CON E 222, or CE 306 in lieu of CON E 222*
Planning and field engineering for concrete and steel construction. Design and applications of concrete formwork to construction. Erection of structural steel. Emerging industry themes.

**CON E 352: Mechanical Systems in Buildings**
(2-2) Cr. 3. F.S.
*Prereq: CON E 222, CON E 251, PHYS 222; or permission of instructor*
Comprehensive coverage of mechanical systems, plumbing, fire protection. Analysis techniques and design principles for each system. Required comprehensive design project for a major building project.

**CON E 353: Electrical Systems in Buildings**
(2-2) Cr. 3. F.S.
*Prereq: PHYS 222 and credit or enrollment in CON E 352; or permission of instructor*
Comprehensive coverage of building electrical systems including power, lighting, fire alarm, security and communications. Analysis techniques and design principles for each system. Required comprehensive design project for a major building project.

**CON E 354: Building Energy Performance**
Cr. 3. F.
*Prereq: CON E 352 or permission of instructor*
Energy performance of buildings, building shells, HVAC, electrical and other building systems. Analysis and evaluation of building performance, energy efficiency, environmental quality, first costs, and operating costs. Strategies to exceed energy code requirements through the ASHRAE Standard 90.1.

**CON E 380: Engineering Law**
(3-0) Cr. 3. F.S.
*Prereq: Junior classification*
Introduction to law and judicial procedure as they relate to the practicing engineer. Contracts, professional liability, professional ethics, licensing, bidding procedures, intellectual property, products liability, risk analysis. Emphasis on development of critical thinking process, abstract problem analysis and evaluation.

**CON E 381: Bidding Construction Projects I**
(0-3) Cr. 1.
*Prereq: Permission of the instructor*
Team development of construction process designs and cost estimates for transportation construction projects under closely simulated conditions. Examine project sites, consult with construction industry mentors, obtain subcontractor and supplier quotations, and submit bids.

**CON E 381A: Bidding Construction Projects I: Heavy and Highway**
(1-0) Cr. 1. F.
*Prereq: Permission of the instructor*
Team development of construction process designs and cost estimates for transportation construction projects under closely simulated conditions. Examine project sites, consult with construction industry mentors, obtain subcontractor and supplier quotations, and submit bids.

**CON E 396: Summer Internship**
Cr. R. Repeatable. SS.
*Prereq: Permission of department and Engineering Career Services*
Professional work period of at least 10 weeks during the summer. Students must register for this course prior to commencing work. Offered on a satisfactory-fail basis only.

**CON E 398: Cooperative Education (Co-op)**
Cr. R. Repeatable. F.S.
*Prereq: Permission of department and Engineering Career Services*
Professional work period. One semester per academic or calendar year. Students must register for this course before commencing work. Offered on a satisfactory-fail basis only.

**CON E 422: Construction Cost Estimating and Cost Engineering**
(2-2) Cr. 3. F.S.
*Prereq: CON E 241, CON E 251, I E 305*
Conceptual and detailed cost estimating. Theory and practice of estimating construction costs of materials, labor, equipment, contingency, overhead and markup. Estimating competencies and bid ethics. Electronic quantity take off and pricing methods. Assemblies costs, unit costs, production rates. Analysis of project profitability, cost analysis and cost control methods. Value engineering. Life cycle cost analysis.

**CON E 441: Construction Planning, Scheduling, and Control**
(2-2) Cr. 3. F.S.
*Prereq: Credit or enrollment in CON E 422*
Integration of previous construction coursework into the planning, scheduling, and management of time, costs, and other resources. Emphasis on preparation and analysis of network schedules. Comprehensive planning and scheduling project. Computer project management applications.

**CON E 481: Bidding Construction Projects II**
(0-3) Cr. 1.
*Prereq: Permission of the instructor*
Similar to Con E 381, except students with previous experience attempt projects with larger scope or lead students with less experience.

**CON E 481A: Bidding Construction Projects II: Heavy and Highway**
(1-0) Cr. 1. F.
*Prereq: Permission of the instructor*
Similar to Con E 381, except students with previous experience attempt projects with larger scope or lead students with less experience.

**CON E 487: Construction Engineering Design I**
(2-2) Cr. 3. F.S.
*Prereq: CON E 340 (B, H), CON E 352 (B, E, M), CON E 353 (B, E, M), CON E 422, CON E 441. Student must be within two semesters of graduation*
The integrated delivery of project services as a team, including preliminary engineering design process, constructability review, interaction with the client, identification of engineering problems, developments of a proposal, identification of design criteria, cost estimating, planning and scheduling, application of codes and standards, development of feasible alternatives, selection of best alternative, and delivery of oral presentations.

**CON E 488: Construction Engineering Design II**
(1-5) Cr. 3. F.S.
*Prereq: CON E 340 (B,H), CON E 352 (B,E,M), CON E 353 (B,E,M), CON E 422, CON E 441. Student must be within two semesters of graduation.*
Application of team design concepts to a construction engineering project. Project planning. Advanced construction and project management.

**CON E 490: Independent Study**
Cr. 1-3. Repeatable. F.S.SS.
*Prereq: Permission of instructor*
Individual study in any phase of construction engineering. Pre-enrollment contract required.