



	FALL	WINTER	SPRING
1 <sup>st</sup> Year	MATH 11 - CALC I CHEM 11 L&L - CHEM I (5) CRIT THINK WRITING (CTW) I - ENGL 1A CENG 7/7L - GRAPH COMM (3/1) ENGR 1/1L - INTRO ENGR (1/1)	MATH 12 - CALC II PHYS 31 L&L - PHYSICS I (5) CRIT THINK WRITING (CTW) II - ENGL 2A CULTURES & IDEAS (C&I) I	MATH 13 - CALC III PHYS 32 L&L - PHYSICS II (5) CULTURES & IDEAS (C&I) II CENG 10/10L - SURVEYING (3/1)
2 <sup>nd</sup> Year	MATH 14 - CALC IV PHYS 33 L&L - PHYSICS III (5) CENG 15/15L - COMP APL CENG (2/1) CENG 41 - STATICS	AMTH 106 - DIFF EQNS CENG 20/20L - GEOLOGY (3/1) CENG 44A/44AL - STR MATLS I (3/1) ENGL 181 - ENGR COMM	CENG 44B - STR MATLS II (2) CENG 115/115L - MATERIALS (4/1) CENG 132 - STRUCT ANAL ELEN 49 - POWER SYS
3 <sup>rd</sup> Year	CENG 121A/121AL - GEOTECH ENGR I (3/1) CENG 145 - TRANS ENGR DES CENG 148/148L - STRUCT SYS (4/1) UNIV CORE REQUIREMENT	AMTH 112 - RISK IN CIV ENGR CENG 121B - GEOTECH ENGR II (2) CENG 125/125L - MUNICIPAL ENG (3/1) CENG 141/141L - FLUIDS/HYDR (4/1) CENG TECH ELECTIVE	CENG 128 - ENGR ECON & BUS (3) CENG 140/140L - WATER RES (4/1) CENG 143/143L - ENVIRON ENG (3/1) CENG 192A CENG PROJ DEV (2) CENG TECH ELECTIVE
4 <sup>th</sup> Year	CENG 192B - CENG PRACTICE (2) CENG 192C - CENG PROF DEV (1) CENG TECH ELECTIVE UNIV CORE REQUIREMENT UNIV CORE REQUIREMENT	CENG 193 - CENG PROJECT DES FREE ELECTIVE CENG TECH ELECTIVE UNIV CORE REQUIREMENT	CENG 194 - CENG DES COMM (1) CENG TECH ELECTIVE UNIV CORE REQUIREMENT UNIV CORE REQUIREMENT

Each course listed in the above table is 4 units unless a different number is shown in parentheses. Each lab is 1 unit. Where available, labs must be taken together with the associated lecture course – **exception: ENGR 1 and ENGR 1L may be taken in different quarters.**

University CORE requirements for engineering students are detailed in the University Bulletin and the CORE Curriculum Handbook. This sample program assumes that all CORE Curriculum requirements will be satisfied by ten required humanities courses in combination with other required program/major course work. Engineering students are expected to use a limited number of selectively chosen courses to satisfy multiple CORE Curriculum requirements to complete all degree program requirements in four years.

Five CENG technical electives are required. One CENG technical elective must be a digital information management and analysis (DIMA) course. Either CENG 160 – GIS (3) or CENG 182 – BIM (3) satisfy the DIMA requirement – whichever of CENG 160 or CENG 182 is not taken as the DIMA course may be taken to satisfy one of the four remaining technical electives. The remaining four CENG technical electives must include a minimum of two design-focused technical electives (Category I below) and one analysis-focused technical elective (Category II below). Students should work with their academic advisor to select the electives that address their professional goals and help prepare them for their senior capstone design project.

**CATEGORY I: CENG DESIGN-FOCUSED TECHNICAL ELECTIVES**

- |                                  |                                  |                                  |
|----------------------------------|----------------------------------|----------------------------------|
| CENG 119 – DES SUSTAIN CONSTRUCT | CENG 136 - ADVANCED CONCRETE DES | CENG 144 - ENVIRON SYSTEMS DES   |
| CENG 133 - WOOD DES              | CENG 137 - EARTHQUAKE ENGR DES   | CENG 146 - COLD FORMED STEEL DES |
| CENG 134 - STEEL DES             | CENG 138 - GEOTECHNICAL ENGR DES | CENG 150 - TRAFFIC ENGR DES      |
| CENG 135 - CONCRETE DES          | CENG 142 - WATER RESOURCES DES   |                                  |

**CATEGORY II: CENG ANALYSIS-FOCUSED TECHNICAL ELECTIVES**

- |                                   |                                       |                                    |
|-----------------------------------|---------------------------------------|------------------------------------|
| CENG 118 - CONSTRUCTION ENG (3)   | CENG 151 - SPEC TOPICS TRANS ENG      | CENG 184 - CONSTRUCTION ADMIN (3)  |
| CENG 123 - ENVIRON REACTION ENG   | CENG 160 - GIS IN WATER RESOURCES (3) | CENG 186 - CONSTRUCTION PLANNING   |
| CENG 139 - GROUNDWATER HYDROL (3) | CENG 161 - SUSTAINABLE WATER RES      | CENG 187 - CONSTRUCTION OPERATIONS |
| CENG 149 - CIVIL SYSTEMS ENGR     | CENG 162 - COMP WATER RESOURCES (3)   | CENG 182 - INTRO TO BIM (3)        |

University CORE Curriculum requirements for engineering students are detailed in the University Bulletin and the CORE Curriculum Guide. The University implemented a new Core Curriculum in the fall of 2009. This Core Curriculum requires that all engineering students complete (a) a set of courses that satisfy designated topic area requirements, (b) a three-course approved Pathway cluster, and (c) coursework that also satisfies five additional learning outcomes. Engineering students can use select courses to satisfy multiple CORE requirements.

### Sample Programs of Study for a CENG Sub-discipline Focus

Typical course work for the first two years of study is provided in the Typical Program of Studies on page 1. Sample programs for an optional focus in a Civil, Environmental and Sustainable Engineering sub-discipline are provided below. Students should work with a faculty advisor to finalize their selection of technical electives. A design-focused technical elective may be substituted for one of the courses marked with a "+", and an analysis-focused technical elective may be substituted for one of the courses marked with a "\*".

CONSTRUCTION ENGINEERING AND MANAGEMENT FOCUS			
<b>JUNIOR</b>	CENG 121A/121AL - GEOTECH I (3/1) CENG 145 - TRANS ENGR DES CENG 148 - STRUCT SYS (4/1) CENG 118 - CONST ENGR (3)	AMTH 112 - RISK IN CIVIL ENG CENG 121B - GEOTECH II (2) CENG 125 - MUNICIPAL ENGR L&L (3/1) CENG 141 - FLUIDS/HYDR L&L (4/1) CENG 184 - CONST ADMIN (3) +	CENG 128 - ENGR ECON (3) CENG 140 - WATER RES L&L (4/1) CENG 143 - ENVIRON ENG L&L (3/1) CENG 192A - CENG PROJ DEVL (1) CENG 119 - DES SUSTAIN CONSTRUCT
<b>SENIOR</b>	CENG 192B - CENG PRACTICE (2) CENG 192C - CENG PROF DEVL (1) CENG 186 - CONST PLANNING + UNIV CORE REQUIREMENT UNIV CORE REQUIREMENT	CENG 193 - PROJECT DESIGN (4) <b>CENG TECH ELECTIVE #</b> UNIV CORE REQUIREMENT UNIV CORE REQUIREMENT	CENG 194 - CENG PROJ COMM (1) CENG 187 - CONST OPERATIONS + UNIV CORE REQUIREMENT UNIV CORE REQUIREMENT

# TECH ELECTIVE MUST BE A Digital Information Management and Analysis (DIMA) COURSE (CENG 160 OR CENG 182)

GEOTECHNICAL ENGINEERING FOCUS			
<b>JUNIOR</b>	CENG 121A - GEOTECH I (3/1) CENG 145 - TRANS ENGR CENG 148 - STRUCT SYS (4/1) UNIV CORE REQUIREMENT	AMTH 112 - RISK IN CIVIL ENG CENG 121B - GEOTECH II (2) CENG 125 - MUNICIPAL ENGR (3/1) CENG 141 - FLUIDS/HYD (4/1) CENG 135 - CONC DES (4/1)	CENG 128 - ENGR ECON (3) CENG 140 - WATER RES (4/1) CENG 143 - ENVIRON ENG (3/1) CENG 192A - CENG PROJ DEVL (1) CENG 138 - GEOTECH DES L&L (4/1)
<b>SENIOR</b>	CENG 192B - CENG PRACTICE (2) CENG 192C - CENG PROF DEV (1) CENG TECH ELECTIVE UNIV CORE REQUIREMENT UNIV CORE REQUIREMENT	CENG 160 - GIS (3) CENG 193 - CENG PROJ DES CENG 137 - EQK ENGR DES UNIV CORE REQUIREMENT	CENG 182 - BIM (3) CENG 194 - CENG PROJ COMM (1) UNIV CORE REQUIREMENT UNIV CORE REQUIREMENT

STRUCTURAL ENGINEERING FOCUS			
<b>JUNIOR</b>	CENG 121A - GEOTECH I (3/1) CENG 145 - TRANS ENGR CENG 148 - STRUCT SYS (4/1) UNIV CORE REQUIREMENT	AMTH 112 - RISK IN CIVIL ENG CENG 121B - GEOTECH II (2) CENG 125 - MUNICIPAL ENGR (3/1) CENG 141 - FLUIDS/HYD (4/1) CENG 135 - CONC DES (4/1)	CENG 128 - ENGR ECON (3) CENG 140 - WATER RES (4/1) CENG 143 - ENVIRON ENG (3/1) CENG 192A - CENG PROJ DEVL (1) CENG 133 - TIMBER DES *
<b>SENIOR</b>	CENG 192B - CENG PRACTICE (2) CENG 192C - CENG PROF DEV (1) CENG 134 - STEEL DES * UNIV CORE REQUIREMENT UNIV CORE REQUIREMENT	CENG 193 - PROJECT DESIGN (4) CENG 137 - EQK ENGR DES UNIV CORE REQUIREMENT UNIV CORE REQUIREMENT	CENG 182 - BIM (3) CENG 194 - CENG PROJ COMM (1) CENG 138 - GEOTECH DES L&L (4/1) UNIV CORE REQUIREMENT

TRANSPORTATION ENGINEERING FOCUS			
<b>JUNIOR</b>	CENG 121A - GEOTECH I (3/1) CENG 145 - TRANS ENGR CENG 148 - STRUCT SYS (4/1) UNIV CORE REQUIREMENT	AMTH 112 - RISK IN CIVIL ENG CENG 121B - GEOTECH II (2) CENG 125 - MUNICIPAL ENGR (3/1) CENG 141 - FLUIDS/HYD (4/1) CENG 150 - TRAFFIC DES	CENG 128 - ENGR ECON (3) CENG 140 - WATER RES (4/1) CENG 143 - ENVIRON ENG (3/1) CENG 192A - CENG PROJ DEVL (1) CENG 151 - SPEC TOPICS TRAN +
<b>SENIOR</b>	CENG 192B - CENG PRACTICE (2) CENG 192C - CENG PROF DEV (1) CENG 149 - CIVIL SYS ENG + UNIV CORE REQUIREMENT UNIV CORE REQUIREMENT	CENG 160 - GIS (3) CENG 193 - CENG PROJ DES (4) CENG TECH ELECTIVE UNIV CORE REQUIREMENT	CENG 194 - CENG PROJ COMM (1) CENG 197 OR CENG 199 + UNIV CORE REQUIREMENT UNIV CORE REQUIREMENT

WATER RESOURCES / ENVIRONMENTAL ENGINEERING FOCUS			
<b>JUNIOR</b>	CENG 121A - GEOTECH (3/1) CENG 145 - TRANS ENGR CENG 148 - STRUCT SYS (4/1) UNIV CORE REQUIREMENT	AMTH 112 - RISK IN CIVIL ENG CENG 121B - GEOTECH II (2) CENG 125 - MUNICIPAL ENGR (3/1) CENG 141 - FLUIDS/HYD (4/1) CENG 123/123L (3/1) or CENG 144	CENG 128 - ENGR ECON (3) CENG 140 - WATER RES (4/1) CENG 143 - ENVIRON ENG (3/1) CENG 192A - CENG PROJ DEVL (1) CENG 142 or CENG 162
<b>SENIOR</b>	CENG 192B - CENG PRACTICE (2) CENG 192C - CENG PROF DEV (1) CENG 139 OR CENG 161 + UNIV CORE REQUIREMENT UNIV CORE REQUIREMENT	CENG 160 - GIS (3) CENG 193 - CENG PROJ DES (4) CENG 123/123L (3/1) or CENG 144 UNIV CORE REQUIREMENT	CENG 194 - CENG PROJ COMM (1) CENG 124, CENG 142, or CENG 162 UNIV CORE REQUIREMENT UNIV CORE REQUIREMENT

## CORE Curriculum Requirements for CENG Majors

All SCU students must complete the University’s CORE Curriculum. This thematic set of courses aims to instill the knowledge, habits of thought and action, and an orientation to society that the University believes will best prepare its graduates for personal and professional life after Santa Clara. Key components include the capacity for critical judgment, clear expression, ethical decision-making, and the concern for others; all of these being characteristic traits of a Jesuit education. The CORE Curriculum requirements listed below must be followed by all students entering the University as first-year students.

There are normally ten required humanities courses in the CORE Curriculum that all SCU students must complete. These courses satisfy the categorical requirements shown below. The CORE Curriculum web site and the CORE Curriculum Guide identify classes that fulfill each categorical requirement. Engineering students can complete one course that satisfies two of these requirements (“double-dip”) as long as the course has been approved (visit <https://www.scu.edu/apps/courseavail/?p=schedule>, click on the “advanced” hyperlink) for both CORE categories.

- o Critical Thinking and Writing I and II (CTW1 and CTW2)
- o Cultures and Ideas I, II, and III (C&I-1, C&I-II, and C&I-III)
- o Religion, Theology, and Culture I, II, and III (RTC-I, RTC-II, and RTC-III)
- o Ethics
- o Diversity

CORE Curriculum requirements for Mathematics, Natural Science (with lab), and Advanced Writing for all engineering students are satisfied by completing required civil engineering major coursework. In addition to the base requirements, students also must complete coursework that satisfies five additional learning outcomes. To finish the civil engineering major in a four-year period, these learning outcomes should be satisfied using either strategically selected base CORE courses (from the list above), pre-approved required or elective major courses, or a pre-approved combination of courses.

The following table indicates the additional learning outcome topics and provides a listing of the pre-approved courses that can be used to satisfy each outcome.

Course Options for Specific, Supplemental Required CORE Curriculum Learning Outcomes				
Science, Technology And Society	Civic Engagement	Social Science	Arts	Experiential Learning
ENGL 181 & CENG 193	ENGR 1 & CENG 193	Various	ENGL 181 & CENG 193	Various

The SCU CORE Curriculum also requires that engineering students complete an approved three-course (12-unit) Pathway or cluster of thematically linked courses. Students will take these courses from a pre-approved Pathway that is administered by an associated group of faculty members. The pre-approved Pathways will offer many more than three course offerings; it is up to each individual student and his/her faculty advisor to select the most appropriate courses for a particular major. The table provided below lists Pathway options and recommendations for civil engineering students. All courses must be taken within the same Pathway; no mixing and matching is allowed.

Students must declare the Pathway that they intend to complete by the end of their sophomore year. Engineering students must take at least one Pathway course (minimum of four units) from outside their major department and any non-major Pathway course(s) should, where possible, satisfy other (base) CORE Curriculum requirements.

Pre-approved Pathway Course Options/Recommendations for Civil Engineering Students				
	Digital Age	Sustainability	Values in Science & Technology	Design Thinking
Course #1	CENG 7	Two from CENG 20, 115, 119, 140, 143, 144, or 161	Two from CENG 115, 119, 140, 143, 144, or 161	8 units from CENG 119, 128, 148, 192A, or 193
Course #2	CENG 15			
Course #3 <sup>a</sup>	PHIL 22 or ENGR 19	PHIL 29 or RSOC 64	PHIL 29 or CHEM 11	PHIL 22 or ENGR 19

<sup>a</sup> ***Departments occasionally change course numbers. Student should verify course numbers.***

As part of the documentation (portfolio) requirements for the CORE Curriculum, students must submit a composite reflection paper during their senior year and three Pathway course-based papers that detail course projects. Formatting requirements and submission information are made available to students at the appropriate time.

**Civil, Environmental and Sustainable Engineering**  
**At**  
**Santa Clara University**

**Mission**

*The Mission of the Department of Civil, Environmental and Sustainable Engineering is to educate and prepare our students for careers in which they can contribute positively to the planning, design, construction, maintenance and advancement of the civil infrastructure critical to the quality of life in a changing world. We do this by providing students with the skills and tools necessary to understand the physical world, to apply this understanding to current and future needs of a sustainable resilient society, and to responsibly and ethically address the impacts that engineered systems can have on a community and its environment. As part of this process, the Department's faculty and students will advance the state of knowledge of the discipline through research, industrial collaboration, publication, and relevant service to their profession and community.*

**Program Educational Objectives**

The educational objectives developed by the Department for its undergraduate program reflect our commitment to providing a program that produces graduates who, within five years of graduation, will:

- **capably design, build, maintain, or improve civil engineering-based systems in the context of environmental, economic, and societal requirements,**
- **serve the community as ethical and responsible professionals, and**
- **engage in life-long learning for professional growth.**

These Program Educational Objectives have been approved by the Department's Industry Advisory Board.

**Program Learning Outcomes**

Program Learning Outcomes describe the abilities, knowledge base, and characteristics that are expected of students at the completion of their undergraduate education. Satisfying these outcomes helps ensure that the aforementioned Program Educational Objectives will be met. Individual outcomes are detailed below.

1. Students will demonstrate:
  - a. an ability to apply knowledge of mathematics, science, and engineering
  - b. an ability to design and conduct experiments, as well as to analyze and interpret data
  - c. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
  - d. an ability to function on multidisciplinary teams
  - e. an ability to identify, formulate, and solve engineering problems
  - f. an understanding of professional and ethical responsibility
  - g. an ability to communicate effectively
  - h. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
  - i. a recognition of the need for, and an ability to engage in life-long learning
  - j. a knowledge of contemporary issues
  - k. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
2. Students will be able to explain basic concepts in management, business, public policy, and leadership; and explain the importance of professional licensure.
3. Students will be able to apply their knowledge of four technical areas within the general discipline of civil engineering. The technical areas can include structural, water resources, environmental, transportation, geotechnical, and construction engineering.
4. Students will develop an understanding of the mission of the University to produce graduates with competence, conscience, and compassion and its relation to professional engineering practice