

## Civil Engineering (CIV)

### Major in Civil Engineering

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#### Civil Engineering (CIV)

The Bachelor of Engineering in Civil Engineering is designed to give students a solid foundation in civil engineering and sciences. It will provide students with a breadth and depth of technical knowledge in the field, preparing them to work immediately in most areas of the profession, including geotechnical engineering, environmental engineering, hydraulics, structural engineering, construction management, and transportation/traffic engineering. Students take courses in chemistry, physics, and math, in addition to a core set of engineering courses common to most engineering disciplines. Students are also introduced to computer software which expedites the design process, and they are taught how to balance engineering designs with economic constraints.

#### Program Educational Objectives

The educational objectives of the civil engineering program are to prepare our graduates to:

1. Establish a successful career in civil engineering.
2. Possess a strong fundamental, scientific and technical knowledge- base, and critical thinking skills, to serve as the foundation for lifelong learning related to the civil engineering profession, and in preparation for graduate studies.
3. Have a broad and well-integrated background in the concepts, theories, and methodologies needed to plan, design, analyze, develop, organize, and manage civil engineering projects.
4. Have expertise in the major areas of civil engineering: structural analysis, design and reliability, transportation systems engineering, and water resources and environmental engineering.

#### Student Outcomes

The students will demonstrate the following:

- (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.

#### Civil Engineering (CIV)

##### Requirements for Acceptance to the Major in Civil Engineering

Students in good academic standing who were admitted to the University but not immediately accepted into the major may apply for acceptance after they meet the following minimum requirements: 1) completion of at least 10 credits of mathematics, physics, chemistry, and engineering courses required for the major, 2) earned a G.P.A. of 3.0 in all mathematics, physics, chemistry, and engineering courses applicable to major requirements with no more than one grade of C or lower, and 3) completion of course evaluations for all transferred courses that are to be used to meet requirements of the major. Students interested in applying for admission are encouraged to talk to the Undergraduate Program Director.

##### Requirements for the major in Civil Engineering (CIV)

The major in Civil Engineering leads to the Bachelor of Engineering degree.

Completion of the major requires approximately 112 credits.

##### I. Mathematics

- a. AMS 151, AMS 161 Applied Calculus I, II

b. AMS 261 Applied Calculus III or MAT 203 Calculus III with Applications

c. AMS 361 Applied Calculus IV: Differential Equations or MAT 303 Calculus IV with Applications

Note: The following alternate calculus course sequences may be substituted for AMS 151, AMS 161 in major requirements or prerequisites: MAT 125, MAT 126, MAT 127 or MAT 131, MAT 132 or MAT 141, MAT 142 or MAT 171.

## 2. Natural Sciences

a. PHY 131/PHY 133, PHY 132/PHY 134 Classical Physics I, II and Laboratories

b. CHE 131/CHE 133, CHE 132/CHE 134 General Chemistry I, II and Laboratories

Note: The following alternate physics course sequences may be substituted for PHY 131/PHY 133, PHY 132/PHY 134: PHY 125, PHY 126, PHY 127, PHY 133, PHY 134 Classical Physics A, B, C and Laboratories or PHY 141, PHY 142, PHY 133, PHY 134 Classical Physics I, II: Honors

c. A basic science elective to be selected from the following list of courses: GEO 102, The Earth; MAR 104, Oceanography; BIO 201, Fundamentals of Biology: From Organisms to Ecosystems; ATM 201, Introduction to Climate and Climate Change

## 3. Laboratories

- CIV 340 Civil Engineering Materials Laboratory
- CIV 341 Geotechnical Engineering Laboratory
- CIV 342 Hydraulics and Environmental Engineering Laboratory

## 4. Civil Engineering

- CIV 210 Land Surveying
- CIV 305 Transportation Systems Analysis I
- CIV 310 Structural Engineering
- CIV 320 Water Supply & Waste Management
- CIV 330 Soil Mechanics
- CIV 410 Principles of Foundation Engineering
- CIV 420 Hydraulics

## 5. Mechanical Engineering

- MEC 101 Engineering Computing and Problem Solving
- MEC 102 Engineering Computing and Problem Solving II
- MEC 203 Engineering Graphics and CAD
- MEC 214 Probability and Statistics for Mechanical Engineers
- MEC 260 Engineering Statics
- MEC 262 Engineering Dynamics
- MEC 363 Mechanics of Solids
- MEC 364 Introduction to Fluid Mechanics

## 6. Technology and Society

- EST 393 Project Management

## 7. Engineering Design

- CIV 312 Design of Civil Engineering Structures
- CIV 440 Senior Design I
- CIV 441 Senior Design II

## 8. Writing and Oral Communication Requirement

- CIV 300 Technical Communication

## 9. Engineering Economics

- EST 392 Engineering and Manufacturing Economics or ECO 108 Introduction to Economics

## 10. Engineering Ethics

- ESE 301 Engineering Ethics and Societal Impact or CME 233 Ethics and Business Practices for Engineers

## 11. Civil Engineering Specializations

The area of specialization, composed of four electives, must be declared in writing by the end of the junior year. The area of specialization is selected in consultation with a faculty advisor.

The four areas of specialization are transportation engineering, geotechnical engineering, water resources and environmental engineering, and structural engineering and construction materials.

#### Areas of Specialization

Each area of specialization requires a minimum of two electives from this list. An additional two electives may be taken from any of the specializations.

#### Transportation Engineering

- CIV 306 Transportation Systems Analysis II (required for the Transportation Engineering Specialization)
- GSS 313 GIS Design and Application I and GSS 314: GIS Laboratory [co-requisites] – only counts as one
- GSS 325 GIS Design & Applications II
- MEC 320 Numerical Methods in Engineering Design and Analysis

#### Geotechnical Engineering

- GEO 318 Engineering Geology and Coastal Processes
- GEO 347 Remote Sensing
- MEC 320 Numerical Methods in Engineering Design and Analysis
- MEC 442 Introduction to Experimental Stress Analysis
- MEC 455 Applied Stress Analysis

#### Water Resources and Environmental Engineering

- CIV 422 Introduction to Coastal Engineering
- CIV: 423 Coastal Engineering Planning and Design
- CIV: 424 Stormwater Management and Design
- MEC 393 Engineering Fluid Mechanics
- ESM 212 Introduction to Environmental Materials Engineering
- GEO 315 Groundwater Hydrology
- GEO 347 Remote Sensing

#### Structural Engineering and Construction Materials

- CIV 414 Advanced Construction Materials
- MEC 402 Mechanical Vibrations
- MEC 411 Control System Analysis and Design
- MEC 442 Experimental Stress Analysis
- MEC 455 Applied Stress Analysis

#### Grading

All courses taken to satisfy requirements 1 through 10 above must be taken for a letter grade. The grade point average for the courses MEC 260, 262, 280, 316, 363, 364, CME 304, CIV 305, 310, 320, 330, 410, 420, 440, 441, and all specialization and technical electives must be at least 2.00. A minimum grade of “C” in PHY 131 or PHY 125, AMS 151 or MAT 131 or MAT 125, MEC 260, MEC 262 and CIV 440 is required for the BE degree. When a course is repeated, the higher grade will be used in calculating this average.

#### Sample Course Sequence for the Major in Civil Engineering A course planning guide for this major may be found here.

##### FRESHMAN

FALL	Credits
First Year Seminar 101	1
WRT 102 (WRT)	3
AMS 151 (QPS)	3
PHY 131/133 (SNW)	4
MEC 101	2

Basic Science Elective	3
Total	16

<b>SPRING</b>	<b>Credits</b>
First Year Seminar 102	1
AMS 161	3
PHY 132/134	4
MEC 102	2
CHE 131	4
SBC course	3
Total	17

**SOPHOMORE**

<b>FALL</b>	<b>Credits</b>
AMS 261	4
CHE 132/133	5
MEC 260	3
EST 392 (SBS)	3
MEC 214	1
Total	16

<b>SPRING</b>	<b>Credits</b>
AMS 361	4
MEC 262	3
MEC 363	3
MEC 203	3
CHE 134	1
SBC course	3
Total	17

**JUNIOR**

<b>FALL</b>	<b>Credits</b>
MEC 364	3
CIV 210	1
CIV 305	3
CIV 310 (TECH)	3
CIV 340	2
ESE 301 (STAS)	3
Total	15

<b>SPRING</b>	<b>Credits</b>
EST 393	3
CIV 300	1

CIV 312	3
CIV 320	3
CIV 330	3
CIV 341	2
Total	15

**SENIOR**

<b>FALL</b>	<b>Credits</b>
CIV 440*	3
CIV 410	3
CIV 420	3
CIV 342	1
Specialization course	3
Specialization course	3
Total	16

<b>SPRING</b>	<b>Credits</b>
CIV 441*	3
SBC course	3
SBC course	3
Specialization course	3
Specialization course	3
Total	15

\* Note: This course partially satisfies the following: ESI, CER, SPK, WRTD, SBS+, STEM+, EXP+. For more information contact the CEAS Undergraduate Student Office.

**CIV Faculty**

Faculty information for this program can be found at [http://me.eng.sunysb.edu/index.php?option=com\\_content&view=article&id=83&Itemid=169](http://me.eng.sunysb.edu/index.php?option=com_content&view=article&id=83&Itemid=169)

# CIV

## Civil Engineering

### CIV 100: Infrastructure

This course explores the science and engineering of the built environment and the important role of infrastructure in daily life. Students will learn about major infrastructure systems including transportation, water resources, environmental, energy, and structural infrastructure.

**SBC:** TECH

3 credits

### CIV 210: Land Surveying

Introduces the general mathematical and physical concepts related to engineering surveying. Covers plane surveying, geodesy, geodetics, measurement techniques and instruments, leveling, error theory, survey adjustments, coordinate systems and datums. Practical measurement techniques and instruments, and survey staking. Introduces photogrammetry and remote sensing, geographic information systems (GIS).

**Prerequisites:** PHY 127 or 132; MAT 127 or 132 or 142 or AMS 161; CIV major

1 credit

### CIV 300: Technical Communication

Aims to ensure proficiency in the types of communication necessary for success in the engineering professions. Provides students with the ability to apply their knowledge of correct written and spoken English to the diverse modes of communication encountered and used by engineers in the professional workplace. Combined with laboratory courses to create practical application of writing skills to civil engineering laboratory reports.

**Prerequisites:** WRT 102 and CIV major  
**Corequisite:** CIV 340

1 credit, S/U grading

### CIV 305: Transportation Systems Analysis I

Focused on highway transportation planning and traffic analysis. Topics include transportation planning, performance analysis of highway and road design, highway segments, highway and airport pavement design, geometric design, sight elevations and alignment, highway traffic operations, queuing theory and modeling, traffic analysis and control, travel demand models, ethics, sustainability, and environmental considerations during transportation planning.

**Prerequisites:** AMS 361 or MAT 303; CIV major

3 credits

### CIV 306: Transportation Systems Analysis II

Focus is on high-speed ground transportation, urban transit and advanced modeling. Transportation and systems modeling. Planning, modeling and design of high-speed transit systems. Urban travel demand modeling. Transportation network modeling, uncongested and congested network models, planning and design issues of urban transit design. Highway asset management. Environmental transportation models, sustainability. Transportation system comparisons and evaluation, benefit and revenue cost analysis, and multi-criteria analysis.

**Prerequisite:** CIV 305

3 credits

### CIV 310: Structural Engineering

Mechanics of materials related to engineering structures. Theory and analysis of structures, structural form and modeling. Load paths. Determinate and indeterminate structure analysis. Structural analysis using virtual work. Stiffness and flexibility methods. Influence lines. Design of structures with different materials: concrete, steel-concrete composites, timber and masonry structures. Structural systems. Structural reliability and serviceability.

**Prerequisites:** MEC 363; CIV major

**SBC:** TECH

3 credits

### CIV 312: Design of Civil Engineering Structures

The application of the principles of structural engineering to the design of steel, concrete, masonry and timber structures. Design of cold formed steel structures. Design of composite structures. Design of hydraulic structures. Design with concrete and pre-stressed concrete. Design of beams, columns, and structural members for various loadings. Connections. Structural systems. Code requirements for various loading applications. Load paths and loads from earthquake and wind forces. Analysis of frames and wood engineering.

**Prerequisite:** CIV 310

3 credits

### CIV 320: Water Supply and Waste Management

Water and wastewater planning. Physical water and wastewater treatment processes. Chemical water and wastewater treatment processes. Settling, Mass, material and energy balances. Filtration and disinfection, membrane and absorption processes. Biological wastewater treatment processes. Air pollution and incinerators. Solid waste/landfills. Modeling applications. Economics and financial calculations. Environmental laws and regulations. Life cycle assessment and sustainability.

**Prerequisites:** MEC 364; CME 304; CIV major

3 credits

### CIV 330: Soil Mechanics

Soil relationships and classification, consolidation and settlement analysis. Soil compaction. Stress distribution, slope stability, and retaining structures. Foundation engineering introduction. Site improvements. Geo-synthetics, geotechnical earthquake engineering, geo-environment. In-situ subsurface characterization, in-situ testing and field instrumentation. Ground water modeling seepage forces, flow nets, and computer applications.

**Prerequisite:** CIV 310

3 credits

### CIV 340: Civil Engineering Materials Laboratory

Laboratory experiments that illustrate the basic analysis and behavior of civil engineering materials and structures. Mechanical loading and analysis of steel, wood, and concrete; quality control tests and field testing; testing of concrete structures. Lab report writing, measurement analysis, and error propagation theory. This course has an associated fee. Please see [www.stonybrook.edu/coursefees](http://www.stonybrook.edu/coursefees) for more information.

**Prerequisite:** MEC 363

**Corequisite:** CIV 310

2 credits

### CIV 341: Geotechnical Engineering Laboratory

Laboratory experiments that illustrate the basic analysis and behavior of soils, including liquid and plastic limits, grain size, compaction, permeability, consolidation, compression and shear strength. Lab report writing, measurement and error analysis. This course has an associated fee. Please see [www.stonybrook.edu/coursefees](http://www.stonybrook.edu/coursefees) for more information.

**Prerequisite:** MEC 363

**Corequisite:** CIV 330

2 credits

### **CIV 342: Water Resources and Environmental Engineering Laboratory**

Laboratory experiments that illustrate the fundamentals of hydraulics with application to water resources and physical, chemical, and biological treatment techniques for purification of water. Lab report writing, measurement and error analysis. This course has an associated fee. Please see [www.stonybrook.edu/coursefees](http://www.stonybrook.edu/coursefees) for more information.

*Prerequisite: MEC 364*

*Pre- or Corequisite: CIV 320*

1 credit

### **CIV 410: Principles of Foundation Engineering**

Strength, deformation and stress distributions in soils. Drained and undrained soil strength, soil exploration and sampling, in-situ subsurface characterization, in-situ testing and field instrumentation. Soil-structure interactions. Bearing capacity, footings and mats. Settlement and consolidation. Single piles and pile groups, load transfer to soils, pile driving, and pile load tests. Lateral loading of piles. Auger cast piles. Drilled shafts. Modeling and computer applications.

*Prerequisites: CIV 312 and CIV 330*

3 credits

### **CIV 414: Advanced Construction Materials**

This course is targeted at senior undergraduate or graduate students in civil engineering specializing in structural materials. Students from material science engineering or mechanical engineering may also take this course. This course introduces emerging structural materials in construction which includes high performance concrete, fiber-reinforced polymers, calcium sulfoaluminate cement, and high performance steel.

*Prerequisite: CIV 340 or MEC 317 or ESM 335*

3 credits

### **CIV 420: Hydraulics**

Fundamentals of hydraulics. Open channel hydraulics, sediment transportation in open channels. Coastal engineering hydraulics. Simulation in hydraulics. Water resources planning and management, storm sewers and flood detention. River flood waves. Storm analysis, intensity, and frequency. Stochastic hydraulics and risk assessments. Eco-hydraulics. Modeling and computer applications.

*Prerequisites: MEC 364 and CIV major*

3 credits

### **CIV 422: Introduction to Coastal Engineering**

Basic hydrodynamics of water waves. Topics include linear wave theory, energy, power and energy propagation, wave refraction, shoaling and breaking in the nearshore, diffraction by breakwaters and gaps, reflection and basin oscillations, wave statistics and spectra, wind-wave hindcast/forecast, wave forces on piles and pipes. Some coastal processes due to nonlinearity, including wave set-up/set-down, nearshore circulations and storm surges. Physical interpretations of mathematical formulas are particularly emphasized.

*Prerequisite: MEC 364*

3 credits

### **CIV 423: Coastal Engineering Planning and Design**

Planning and design of various types and function of coastal structures and shore protective measures. Considerations of site conditions; Design processes; Design of sloping - and vertical- front coastal structure; Scour and scour protection; coastal sediment transport; shore protection measures such as coastal armoring, beach restoration, and beach stabilization; and introduction to harbor and marina.

*Prerequisite: MEC 364 or permission of instructor.*

*Advisory Prerequisite: CIV 422*

3 credits

### **CIV 424: Stormwater Management & Design**

The main focus of this course is on the design of stormwater management practices to reduce runoff pollutants from impacting local waterways. Topics to be discussed will include an overview on regulations governing stormwater activities, stormwater impacts, basic hydrology, urban hydrology (rational method and TR55), stormwater runoff calculations, design and criteria for various standard practices, erosion and sediment control practices, with emphasis on the New York State stormwater management design requirements for meeting water quality and flood control. Policy discussion will include site redevelopment, flooding and drainage issues.

*Pre- or Corequisite: CIV 420*

3 credits

### **CIV 440: Senior Design I**

Students will participate in structured engineering projects under supervision. They will be assigned to carry out significant

professional responsibilities and whatever additional assignments are determined by their advisors. Assignments will cover in-situ data management and testing, specific limits, engineering judgments and reporting.

*Prerequisites: CIV 305 and 312 and 320 and 330 and 340*

3 credits

### **CIV 441: Senior Design II**

Students will participate in structured engineering projects under supervision. They will be assigned to carry out significant professional responsibilities and whatever additional assignments are determined by their advisors. Assignments will design of civil engineering structures, design of special structures, comprehensive and realistic design project using the systems approach, design choices and their effect upon the environment, design constraints including constructability, minimization of environmental impact, and cost-effectiveness, managerial and professional aspects of design practice. This course has an associated fee. Please see [www.stonybrook.edu/coursefees](http://www.stonybrook.edu/coursefees) for more information.

*Prerequisite: CIV 440*

3 credits

### **CIV 499: Independent Research**

This course is designed to allow undergraduates an opportunity to do independent research with a faculty member in Civil Engineering. Permission to register requires the agreement of the faculty member to supervise the research. May be repeated twice but only three credits of research electives may be counted as technical electives.

*Prerequisite: Permission of department*

0-3 credits