Civil Engineering (CIV)

Major in Civil Engineering

Department of Civil Engineering, College of Engineering and Applied Sciences

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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 lifelong 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.

1. Mathematics
   a. AMS 151, AMS 161 Applied Calculus I, II
b. AMS 261 Applied Calculus III or MAT 203 Calculus III with Applications or MAT 205 Calculus III

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 Civil Engineering Hydraulics 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 Introduction to Geotechnical Engineering
- 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 or SBC 354 Drawing for Design - 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

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
- CIV 407 Transportation Economics (required for the Transportation Engineering Specialization)
- EDP 302 The Built Environment
- EDP 307 Theories and Design of Urban Settlements
- GSS 313 GIS Design and Application I and GSS 314: GIS Laboratory [co-requisites] – only counts as one
- GSS 325 GIS Design & Applications II

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
- ENV 310 Sustainability and Renewable Energy - Costa Rica
- ESM 212 Introduction to Environmental Materials Engineering
- GEO 315 Groundwater Hydrology
- GEO 347 Remote Sensing
- MEC 393 Engineering Fluid Mechanics

Structural Engineering and Construction Materials
- CIV 414 Advanced Construction Materials
- CIV 436 Pre-stressed Concrete
- EDP 302 The Built Environment II
- EDP 305 Risk Assessment and Sustainable Development
- EDP 307 Theories and Design of Urban Settlements
- ESG 332 Materials Science I: Structure and Properties of Materials
- ESM 325 Diffraction Techniques and Structure of Solids
- MEC 320 Numerical Methods in Engineering Design and Analysis
- 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 11 above must be taken for a letter grade. The grade point average for the courses MEC 260, 262, 280, 363, 364, CIV 210, 305, 310, 312, 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 or MAT 141, 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.

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| **SOPHOMORE** |          |         |
| **FALL**  |          |         |
| AMS 261 |         | 4       |
| CHE 132/133 |         | 5       |
| MEC 260 |         | 3       |
| EST 392 (SBS) |         | 3       |
| MEC 214 |         | 1       |
| **Total** |          | 16      |
| **SPRING** |          |         |
| AMS 361 |         | 4       |
| MEC 262 |         | 3       |
| MEC 363 |         | 3       |
| MEC 203 or SBC 354 |         | 3       |
| CHE 134 |         | 1       |
| SBC course |         | 3       |
| **Total** |          | 17      |

<p>| <strong>JUNIOR</strong> |          |         |
| <strong>FALL</strong>  |          |         |
| MEC 364 |         | 3       |
| CIV 210 |         | 1       |
| CIV 305 |         | 3       |</p>
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<td>ESE 301 (STAS)</td>
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**SENIOR**

**FALL**

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* 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
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, geodetic 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
1 credit

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

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
The role and ethical responsibilities of a structural engineer. Structures and their structural systems. Loads and load paths through structures. Analysis, behavior, and design of determinate and indeterminate beams, trusses and framed structures under static loads using various methods. Shear, moment, and deflection diagrams. Influence lines. Computer aided structural analysis.

Prerequisites: MEC 363; CIV or MEC or ESG major
3 credits

CIV 312: Steel and Reinforced Concrete Design
Strength limit states, behavior, and proportioning of steel and reinforced concrete members. Design principles also address serviceability and constructability limit states. Steel tension member and connection design including gross and net yielding and block shear. Steel and reinforced concrete flexural members and columns. Shear capacity design for reinforced concrete beams. Reinforced concrete T-beams, doubly reinforced beams, and one-way slabs. Introduction to combined loading for both steel and concrete members.

Prerequisite: CIV 310
3 credits

CIV 320: Water Supply and Waste Management
This course will cover the planning, design, and operation of water and wastewater infrastructure. Specific topics include: water and wastewater planning; environmental laws and regulations; water quality; physical water and wastewater treatment processes; chemical water and wastewater treatment processes; biological wastewater treatment processes; mass, material and energy balances; economics and financial calculations; resiliency and sustainability.

Prerequisites: MEC 364; CIV major
3 credits

CIV 330: Introduction to Geotechnical Engineering
This course will introduce students to the origin of soils and weight-volume relationships; Soil classification for engineering applications; Soil compaction; Flow of water through soils; Stresses in soil masses: Total, pore pressure, and effective stresses; Stresses in soil masses due to external loads: Foundations and Excavations; Consolidation of saturated clay deposits; Time rate of consolidation; Stresses in solid: Mohr's Circle; Shear strength of soils and Mohr-Coulomb failure criteria; Lateral earth pressure: at-rest conditions; In-situ tests: ground exploration for civil engineering applications.

Prerequisite: MEC 363
Corequisite: CIV 341
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 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 for more information.

Prerequisite: MEC 363
Corequisite: CIV 330
2 credits
CIV 342: Civil Engineering Hydraulics Laboratory

Laboratory experiments are conducted that illustrate the fundamentals of hydraulics including pipes under pressure (water mains and networks), and open channel flow (sewers, drains, and channel sections). The fundamental concepts of energy, momentum and continuity will be discussed. Topics covered include but are not limited to fluid statics, orifice and free jet flow, hydrostatic pressure, flow over weirs, energy loss in pipes and bends, and critical, subcritical and supercritical flow. Lab report writing, measurement and error analysis. This course has an associated fee. Please see www.stonybrook.edu/coursefees for more information.

Prerequisite: MEC 364
Pre- or Corequisite: CIV 320
1 credit

CIV 407: Transportation Economics

Microeconomics principles applied in the transportation field. Transportation demand and supply. Transportation costs (fixed costs, variable costs) and externalities. Economic and social benefits of transportation. Economic principles for transport pricing, e.g. toll pricing. Cost benefit analysis of a transportation project. History of government regulation of transportation.

Prerequisites: CIV 305 and EST 392 or ECO 108
3 credits

CIV 410: Principles of Foundation Engineering


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


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, diffusion 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 426: Introduction to Environmental Biotechnology

This undergraduate course covers the fundamental concepts of biological processes that are important in natural and engineered environmental systems. The course will incorporate basic fundamental microbiology into a quantifiable engineering context in order to describe, predict and control behavior of environmental biological system.

Prerequisite: CIV 320 or permission of the instructor
3 credits

CIV 436: Prestressed Concrete Design

Introduction to the behavior, analysis, and design of prestressed concrete structural members and structural systems. Limit states addressed will include flexure, shear, torsion, and deflection. Design examples will include indeterminate systems such as multi-span bridges and their construction. The design of prestressed composite beams and prestressed slabs will be presented.

Prerequisite: CIV 312
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 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 but only three credits may be counted as technical elective.

Prerequisite: Permission of department
0-3 credits