

Civil Engineering

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Assistant Professor Wilson
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**Degree Offered: B.S. in Civil Engineering; Areas of
Specialization: Geotechnical, Water Resources, and Structural**

Program Educational Objectives

1. To develop undergraduate student competence in the fundamentals of civil engineering and across a specialty area of structural, geotechnical or water resources engineering.
2. To prepare students in the general areas of logical analysis, critical thinking, rational design, and ethical engineering practice.
3. To prepare students for advanced education in civil engineering and related fields, and to prepare students for professional licensure.

The primary objective of this program is to produce a well-balanced civil engineer capable of entering the civil engineering profession or continuing studies at the graduate level. Graduates will be well-prepared to solve current civil engineering problems, and will have the ability to adapt to problems of the future.

The achievements of civil engineers are well-known to the general public, because civil engineers build the world's infrastructure. In doing so, they can shape the history of nations. Projects that civil engineers work on include: airports, bridges, buildings, dams and waterways, drainage and sewer systems, city roads, and highways.

The undergraduate program offers a balanced approach to civil engineering education. Students take a common core of civil engineering courses, and can specialize in the areas of geotechnical, water resources, or structural engineering. The program is also designed to give students a solid foundation in engineering and science. Students take courses in chemistry, physics, and math, in addition to a core set of engineering courses common to most engineering disciplines. Our civil engineering courses teach students the fundamentals of engineering design, as well as potential applications. Students are taught how to use computer software to expedite the design process, and they are also taught how to balance engineering designs with economic constraints. During their senior year, undergraduate students work with a professor on a design project.

Undergraduate Program

Bachelor of Science in Civil Engineering

Minimum credit hours required—132

In addition to the General Degree Requirements (page 54), the following courses are required:

- CE 101 (1), 201 (3), 301 (3), 302 (3), 402 (3), 413 (3), 423(3), 481 (3)
- ES 316 (3)
- ES 110 (2), 111 (3), 201 (3), 216 (3), 302 (3)
- MATH 231 (4), 283 (3), 335 (3)
- ME 220 (3), 420 (4)
- MENG 300 (2), MENG 351 (1), 421 (3)
- Technical Electives (12): Minimum of 12 credit hours in a civil engineering specialty area. Civil engineering approved electives include:
 - **Geotechnical** (12): CE 420 (3), CE 422 (3), ME 360 (3), ME 409 (3), ME 427 (3), ME 434 (3), ME 442 (4)
 - **Water Resources** (12): ENVE 201 (3), ENVE 301 (3), ENVE 303(3), ENVE 304 (3), ENVE 406 (3), EARTH 440 (4), EARTH 441 (1), EARTH 442 (1), EARTH 443 (1)
 - **Structural** (12): CE 410 (3), CE 412 (3), CE 414 (3), CE 418 (3), CE 420 (3), MENG 304 (3), MENG 441 (3), ME 409 (3), ME 434 (3)

Additional technical electives must be approved by the Department Chair.

Students pursuing a B.S. in Civil Engineering must take all engineering courses for a letter grade.

Civil engineering majors must maintain a minimum GPA of 2.0 in required courses in order to graduate. All engineering majors are required to take the Fundamentals in Engineering (FE) exam as a requirement for graduation.

Sample Curriculum for the Bachelor of Science Degree in Civil Engineering

Semester 1

- | | |
|-------|------------------------------------|
| 1 | CE 101 (civil engineering seminar) |
| 4 | CHEM 121 & 121L (general) |
| 3 | ENGL 111 (college English) |
| 2 | ES 110 (intro) |
| 4 | MATH 131 (calculus) |
| 3 | Social Science |
| <hr/> | |
| 17 | Total credit hours |

Semester 2

- | | |
|-------|----------------------------|
| 3 | ENGL 112 (college English) |
| 3 | ES 111 (intro) |
| 4 | MATH 132 (calculus) |
| 5 | PHYS 121 & 121L (general) |
| <hr/> | |
| 15 | Total credit hours |

Semester 3

- | | |
|-------|---------------------------|
| 4 | CHEM 122 & 122L (general) |
| 3 | ES 201 (statics) |
| 4 | MATH 231 (calculus) |
| 5 | PHYS 122 & 122L (general) |
| <hr/> | |
| 16 | Total credit hours |

Semester 4

- | | |
|-------|---|
| 3 | CE 201 (materials, properties, and testing) |
| 3 | ES 216 (fluid mechanics) |
| 3 | ES 302 (mechanics of materials) |
| 3 | MATH 335 (ordinary differential equations) |
| 3 | ME 220 (surveying and map preparation) |
| 3 | Humanities / Social Science |
| <hr/> | |
| 18 | Total credit hours |

Semester 5

- | | |
|-------|---|
| 3 | CE 301 (construction engineering) |
| 3 | ENGL 341 (technical writing) |
| 3 | ES 316 (engineering practice and economics) |
| 3 | MATH 283 (statistics) |
| 3 | Humanities |
| 3 | Social Science |
| <hr/> | |
| 18 | Total credit hours |

Semester 6

- | | |
|-------|---|
| 3 | CE 302 (structural engineering) |
| 1 | MENG 300 (mechanics lab) |
| 1 | MENG 351 (fluids lab) |
| 3 | MENG 421 (finite element analysis and design) |
| 4 | ME 420 (soil and rock mechanics) |
| 3 | Social Science |
| <hr/> | |
| 15 | Total credit hours |

Semester 7

- | | |
|-------|---------------------------------------|
| 3 | CE 406 (steel) |
| 3 | CE 408 (concrete) |
| 3 | CE 413 (foundation design & analysis) |
| 6 | CE Electives |
| 3 | Humanities |
| <hr/> | |
| 18 | Total credit hours |

Semester 8

- | | |
|-------|-------------------------------------|
| 3 | CE 402 (transportation engineering) |
| 3 | CE 423 (open channel hydraulics) |
| 3 | CE 481 (senior design) |
| 6 | CE Electives |
| <hr/> | |
| 15 | Total credit hours |

Approved Civil Engineering Electives

CE students must take a minimum of 12 elective credit hours in a specialty area

Water Resources Engineering

- 3 ENVE 201 (environmental engineering)
- 3 ENVE 301 (applied principles of environmental engineering)
- 3 ENVE 303 (water treatment process design)
- 3 ENVE 304 (wastewater treatment process design)
- 3 ENVE 406 (environmental engineering unit operations)
- 4 EARTH 440 (hydrological theory and field methods)
- 1 EARTH 441 (aquifer mechanics)
- 1 EARTH 442 (vadose zone processes)
- 1 EARTH 443 (atmospheric dynamics and rainfall processes)

Geotechnical Engineering

- 3 CE 420 (pavement design)
- 3 CE 422 (geotechnical waste containment design)
- 3 ME 360 (exploration and field mapping)
- 3 ME 409 (design of structures)
- 3 ME 427 (site investigation)
- 3 ME 434 (drilling & blasting)
- 4 ME 442 (applied geomechanics)

Structural Engineering

- 3 CE 410 (reinforced masonry and timber design)
- 3 CE 412 (advanced design of steel structures)
- 3 CE 414 (advanced design of concrete structures)
- 3 CE 418 (structural dynamics)
- 3 CE 420 (pavement design)
- 3 MENG 304 (advanced strength of materials)
- 3 MENG 441 (dynamics and vibrations in structural design)
- 3 ME 409 (design of structures)
- 3 ME 434 (drilling & blasting)

Additional technical electives must be approved by the Department Chair.

Minor in Civil Engineering

Minimum credit hours required – 18

The following courses are required:

- 18 credit hours of Civil Engineering courses

Civil Engineering Courses

CE 101, Civil Engineering Seminar, 1 cr, 1 cl hrs

Brief overview of civil engineering topics, including structures, water resources, geotechnical and transportation engineering in the form of seminars by faculty, and guest speakers from industry, consulting, and government.

CE 201, Construction Materials, Properties, and Testing, 3 cr, 3 cl hrs

Prerequisite: CHEM 122

Mechanical behavior of engineering materials, including metals, ceramics, polymers, concrete, wood, bitumens, and asphaltic concretes; explanations of macroscopic behavior in terms of phenomena at the microscopic level.

CE 301, Introduction to Construction Engineering, 3 cr, 3 cl hrs

Prerequisite: Junior standing

Topics covered include: contracting and bonding, planning and scheduling, estimating, project control, and productivity models.

CE 302, Introduction to Structural Engineering, 3 cr, 3 cl hrs

Prerequisites: ES 201, 302

Basic topics in the analysis, behavior, and design of trusses and framed structures under static loads; analysis topics include member forces in trusses, shear and moment diagrams, deflections, simple applications of the force method and slope-deflection; and an introduction to computer applications by means of a general purpose structural analysis program.

CE 402, Introduction to Transportation Engineering, 3 cr, 3 cl hrs

Prerequisite: CE 301 or consent of instructor

Introduction to the design, planning, operation, management, and maintenance of transportation systems. Principles for planning integrated multi-modal transportation systems (highways, air, rail, etc.). Introduction to the layout of highways, airports, and railroads with traffic flow models, capacity analysis, and safety. Functional design concepts for both the facilities and systems areas of study with life cycle costing procedures and criteria for optimization.

CE 406, Design of Steel Structures, 3 cr, 3 cl hrs

Prerequisite: CE 302 or consent of instructor

Behavior and design of steel members subjected to tension, compression and flexural loads, according to AISC specifications. Topics covered include: elastic and inelastic design, buckling of beams and columns, and structural connections.

CE 408, Design of Concrete Structures, 3 cr, 3 cl hrs

Prerequisite: CE 302 or consent of instructor

Study of the strength, behavior and design of reinforced concrete members, including beams, columns and slabs. Topics covered will include serviceability of beams and slabs, control of deflections and cracking, shear design, and bonding.

CE 410, Reinforced Masonry and Timber Design, 3 cr, 3 cl hrs

Prerequisite: CE 302 or consent of instructor

Reinforced masonry design topics covered include: the properties and performance of masonry materials; design criteria and methods in reinforced masonry; and design examples including reinforced masonry walls, masonry columns and pilasters, and rectangular beams. Timber topics covered include: design of beams, columns, trusses, and diaphragms in wood; design of gluelaminated beams; design of wood connections; use of timber design codes and the International Building Code (IBC).

CE 412, Advanced Design of Steel Structures, 3 cr, 3 cl hrs

Prerequisite: CE 406 or consent of instructor

Behavior and design of structural steel beams, columns, frames, and connections. Topics include: elastic and inelastic design, composite beam design, stability of beams and columns, behavior of steel frame structures, design of bolted and welded connections, metallurgical and mechanical properties of welds, braced frame and moment frame design for lateral loads. Extensive use of the current AISC-LRFD design code.

CE 413, Foundation Design and Analysis, 3 cr, 3 cl hrs

Prerequisite: CE 302 or consent of instructor

Principles of foundation engineering. Shear strength of soil. Theories related to and design of retaining structures, shallow foundations, deep foundations, and slope stability.

CE 414, Advanced Design of Concrete Structures, 3 cr, 3 cl hrs

Prerequisite: CE 408 or consent of instructor

Topics covered include: strut and tie models, footings, retaining walls, principles of prestressed concrete, materials and techniques used in these systems, advantages and disadvantages of prestressing methods over regular reinforced concrete, and the design of prestressed concrete structures, such as axially loaded members, beams (for flexure and shear), and slabs.

CE 418, Structural Dynamics, 3 cr, 3 cl hrs

Prerequisites: Math 335 and CE 302 or consent of instructor

Fundamentals of structural dynamics. Analysis of single and multi-degree-of-freedom structures subjected to various types of vibrations. Topics covered will include structural responses to free, harmonic and periodic excitations, step and pulse excitations, and earthquake loads.

CE 420, Pavement Materials and Design, 3 cr, 3 cl hrs

Prerequisites: CE 201, CE 302

Analysis, behavior, performance, and structural design of pavements for highways, bridges and airfields. Topics include: climatic factors, maintenance strategies and life cycle design economics, traffic loadings, recycled pavement materials, evaluation by nondestructive testing (roughness, skid resistance, structural capacity), destructive testing, and rehabilitation of pavement systems.

CE 422, Geotechnical Waste Containment Design, 3 cr, 3 cl hrs*Prerequisites: ME 420; MATH 335*

Design procedures consisting of waste disposal methods, various containment systems, and associated remediation techniques. Waste characterization and soil-waste interactions, contaminant transport in low permeability soils, geosynthetics and soil materials use in waste containment, remedial issues of solidification and stabilization and barrier design, and landfill- and surface impoundment-related design, including liners, leachate and gas collection and removal, final covers, static and seismic slope stability, and settlement analysis. Geotechnical problem definition, application of field and laboratory test data, use of computer models for analysis and design.

CE 423, Open Channel Hydraulics, 3 cr, 3 cl hrs*Prerequisites: ES 216; MATH 335*

Conservation laws for transient flow in open channels. Analysis of simple waves, hydraulic jumps, non-reflective boundary conditions, dam-breaks, overland flows. Prediction and mitigation of flood waves.

CE 481, Senior Engineering Design, 3 cr, 3 cl hrs*Prerequisite: Senior standing*

A semester-long civil engineering design project organized and directed by a faculty member.

CE 491, Special Topics in Civil Engineering, 2-3 cr*Prerequisite: Senior standing or consent of instructor*

New and developing areas of knowledge in civil engineering offered to augment the formal course offerings.

Faculty Research Interests

Cal—Air Quality Engineering, Civil, Environmental, and Chemical Engineering

Ghosh—Macro Behavior of Composites, Structural Health Monitoring and Restoration, Finite Element Analysis, Construction Materials and Project Management, Experimental Mechanics and Instrumentation

Hendrickx—Vadose Zone Hydrology, Water and Salt Balance of Natural and Irrigated Systems, Evapotranspiration, Remote Sensing, Soil Physics, Electromagnetic Induction

Kuhn—Geotechnical Engineering

Richardson—Biological Wastewater Treatment, Groundwater Contamination, Site Remediation

Wilson—Structural vibration control, fuzzy control, earthquake engineering

Electrical Engineering

*Professors Rison, Thomas**Associate Professors R. Bond, Teare (Chair of the Department), Wedeward**Assistant Professors El-Osery, Erives**Adjunct Faculty Calloni, Krehbiel, Mansfield, Meason,**Parameswariah, Reicher, Restaino, Wick, Xiao*

Degrees Offered: B.S. in Electrical Engineering; M.S. in Electrical Engineering

Mission

The mission of the New Mexico Tech Electrical Engineering Department is two-fold: (1) to develop and maintain a program of excellence in teaching which ensures that our graduates have technical knowledge and professional skills they need to become effective engineers in the rapidly-changing technical environment of today's society, so that these graduates will contribute to the growth and development of New Mexico and our nation, and (2) to develop and maintain state-of-the-art research programs which are responsive to the needs of industry and government, which provide excellent educational opportunities for students, and which provide an environment for intellectual growth and excitement.

Program Educational Objectives

1. *Graduates will be technically competent within the degree of Electrical Engineering.* They will have the ability to synthesize and apply engineering knowledge and fundamentals to solving complex, real-world electrical engineering problems. They will demonstrate the ability to pursue lifelong learning in engineering, thus reinforcing and expanding on their engineering fundamentals and their depth and strength in mathematics and science.
2. *Graduates will be prepared for professional practice in electrical engineering.* They will have the ability to understand ethical and social choices inherent in the engineering profession and apply them in their daily practice of engineering. They will have the ability to work effectively in teams, through having the ability to communicate effectively, both orally and in writing; and they will appreciate the importance of encouraging the best in others.

Undergraduate Program

The Department of Electrical Engineering concentrates on a high-quality undergraduate program in electronics and design, combined with a firm intellectual foundation in the fundamentals of circuits, signals, and systems. As with other degree programs at Tech, students are also provided with a breadth of knowledge in the basic sciences, mathematics, humanities, and social sciences.

Laboratories constitute an important part of the electrical engineering program. The laboratories are closely coupled with the lecture parts of courses and utilize modern, state-of-the-art equipment. Personal computer-based instruments and software packages provide students with up-to-date engineering and design techniques.

Design is integrated into all aspects of the curriculum. Students take an "Introduction to Design" course in the second semester of their junior year. This and their other course work prepare students for two Senior Design Project courses, in which students apply material learned in the classroom to real-world problems. Projects are available from the greater Tech community, including Tech research labs, Langmuir Laboratory for Atmospheric Research, the Energetic Materials Research and Testing Center, and the VLA and VLBA facilities of the National Radio Astronomy Observatory.

Five-year programs are available in which students obtain dual degrees in electrical engineering and in related fields such as computer science, physics, or mathematics.

Graduates of Tech's electrical engineering program will be well equipped with the practical skills necessary for immediate employment, as well as with the intellectual base for graduate studies and lifelong learning.