Civil Engineering (MR)

Master of Civil Engineering Degree Requirements

Students may choose from the specializations below to complete coursework within a focus area.

Degrees earned will be distributed as: "Master of Civil Engineering" without specialization specifications.

Computing & Systems Specialization

- Select at least 6 courses in the CE department

Code	Title	Hours
Core Courses		
Select a minimum of two courses of the following:		6
CE 536	Introduction to Numerical Methods for Civil Engineers	
CE 537	Computer Methods and Applications	
CE 591	Special Topics in Civil Engineering Computing	
CE 737	Computer-Aided Engineering Systems	
CE 791	Advanced Topics in Civil Engineering Computing (High performance computer modeling)	
CE 791	Advanced Topics in Civil Engineering Computing (Evolutionary computation)	
CE 791	Advanced Topics in Civil Engineering Computing (Inverse modeling)	
CE 791	Advanced Topics in Civil Engineering Computing (Advanced methods for systems analysis)	
Electives [1]		
CE 775	Modeling and Analysis Of Environmental Systems	3
CE 776	Advanced Water Management Systems	3
CE 796	Advanced Topics in Water Resource and Environmental Engineering (Stochastic Methods)	3
CE 724	Probabilistic Methods Of Structural Engineering	3
CE 721	Matrix and Finite Element Structural Analysis	3
Electives [2]		
ISE 501	Introduction to Operations Research	3
MA/ISE 505	Linear Programming	3
ISE 708	Integer Programming	3
ISE 709	Dynamic Programming	3
ISE 712	Bayesian Decision Analysis For Engineers and Managers	3
MA 501	Advanced Mathematics for Engineers and Scientists I	3
MA 502	Advanced Mathematics for Engineers and Scientists II	3
MA/CSC 580	Numerical Analysis I	3
MA/CSC 583	Introduction to Parallel Computing	3
MA 584	Numerical Solution of Partial Differential Equations--Finite Difference Methods	3
MA 587	Numerical Solution of Partial Differential Equations--Finite Element Method	3
MA/ST 706	Nonlinear Programming	3
CSC 501	Operating Systems Principles	3
CSC 548	Parallel Systems	3
Total Hours		**63**

[1] Other relevant departmental courses
[2] Other recommended courses

Construction Engineering Specialization

Code	Title	Hours
Select a minimum of seven courses with CON prefix		21
Select one non-CON prefix civil engineering course:		3
CE 536	Introduction to Numerical Methods for Civil Engineers	
CE 537	Computer Methods and Applications	
CE 538	Information Technology and Modeling	
CE 592	Special Topics in Construction Engineering (Robotic Vision Systems)	
CE 522	Theory and Design Of Prestressed Concrete	
CE 523	Theory and Behavior Of Steel Structures	
CE 524	Analysis and Design Of Masonry Structures	
CE 528	Structural Design in Wood	
CE 548	Engineering Properties Of Soils I	
CE 549	Soil and Site Improvement	
CE 744	Foundation Engineering	
CE 503	Transportation System Design	
CE 504	Airport Planning and Design	
CE 755	Highway Pavement Design	
CE 590	Special Topics In Civil Engineering (Facilities Engineering)	
Select two of the following:		3
CON XXX		
CE 536	Introduction to Numerical Methods for Civil Engineers	
CE 537	Computer Methods and Applications	
CE 538	Information Technology and Modeling	
CE 592	Special Topics in Construction Engineering (Robotic Vision Systems)	
CE 522	Theory and Design Of Prestressed Concrete	
CE 523	Theory and Behavior Of Steel Structures	
CE 524	Analysis and Design Of Masonry Structures	
CE 528	Structural Design in Wood	
CE 548	Engineering Properties Of Soils I	
CE 549	Soil and Site Improvement	
CE 744	Foundation Engineering	
CE 503	Transportation System Design	
CE 504	Airport Planning and Design	
CE 755	Highway Pavement Design	
CE 590	Special Topics In Civil Engineering (Facilities Engineering)	
ISE 501	Introduction to Operations Research	
ISE 510	Applied Engineering Economy	
ISE 562	Simulation Modeling	
ST 515	Experimental Statistics for Engineers I	

Code	Title	Hours
ST 516	Experimental Statistics For Engineers II	
EGR 590	Special Topics in Engineering (Environmental Compliance for Facilities Engineers)	
CE 675	Civil Engineering Projects (3 hours maximum)	3
Total Hours		**30**

Environmental, Water Resources, and Coastal Engineering Specialization

• 30 graduate-level credit hours

Code	Title	Hours
CE 607	Water Resource and Environmental Engineering Seminar	1
Total Hours		**1**

Geotechnical and Geoenvironmental Engineering Specialization

• 30 graduate-level credit hours

Code	Title	Hours
CE 675	Civil Engineering Projects (Independent Study)	3
Total Hours		**3**

Structural Engineering and Mechanics Specialization

Code	Title	Hours
Core Courses		
CE 515	Advanced Strength of Materials	3
CE 526	Finite Element Method in Structural Engineering	3
CE 527	Structural Dynamics	3
Select one of the following SEM Behavior and Design courses:		3
CE 522	Theory and Design Of Prestressed Concrete	
CE 523	Theory and Behavior Of Steel Structures	
CE 524	Analysis and Design Of Masonry Structures	
CE 528	Structural Design in Wood	
CE 529	FRP Strengthening and Repair of Concrete Structures	
CE 726	Advanced Theory Of Concrete Structures	
CE 794	Advanced Topics in Structures and Mechanics	
Select two of the following additional SEM courses:		6
CE 525	Advanced Structural Analysis	
CE 721	Matrix and Finite Element Structural Analysis	
CE 530	Properties of Concrete and Advanced Cement-Based Composites	
CE 714	Stress Waves	
CE 718	Constitutive Modeling of Engineering Materials	
CE 730	Mechanics and Failure of Quasi-Brittle Materials	
CE 723	Advanced Structural Dynamics	
CE 724	Probabilistic Methods Of Structural Engineering	
CE 725	Earthquake Structural Engineering	
CE 522	Theory and Design Of Prestressed Concrete	
CE 523	Theory and Behavior Of Steel Structures	
CE 524	Analysis and Design Of Masonry Structures	
CE 528	Structural Design in Wood	
CE 529	FRP Strengthening and Repair of Concrete Structures	
CE 726	Advanced Theory Of Concrete Structures	
CE 794	Advanced Topics in Structures and Mechanics	
Electives		
Total Hours		**18**

Electives

Code	Title	Hours
CE 525	Advanced Structural Analysis	3
CE 721	Matrix and Finite Element Structural Analysis	3
CE 530	Properties of Concrete and Advanced Cement-Based Composites	3
CE 714	Stress Waves	3
CE 718	Constitutive Modeling of Engineering Materials	3
CE 730	Mechanics and Failure of Quasi-Brittle Materials	3
CE 723	Advanced Structural Dynamics	3
CE 724	Probabilistic Methods Of Structural Engineering	3
CE 725	Earthquake Structural Engineering	3
CE 522	Theory and Design Of Prestressed Concrete	3
CE 523	Theory and Behavior Of Steel Structures	3
CE 524	Analysis and Design Of Masonry Structures	3
CE 528	Structural Design in Wood	3
CE 529	FRP Strengthening and Repair of Concrete Structures	3
CE 726	Advanced Theory Of Concrete Structures	3
CE 794	Advanced Topics in Structures and Mechanics	1-3
CE 537	Computer Methods and Applications	3
CE 591	Special Topics in Civil Engineering Computing	1-6
CE 737	Computer-Aided Engineering Systems	3
CE 791	Advanced Topics in Civil Engineering Computing (High Performance Computing)	1-3
CE 548	Engineering Properties Of Soils I	3
CE 593	Special Topics in Geotechnical Engineering (Unsaturated Soil Mechanics)	3
CE 593	Special Topics in Geotechnical Engineering (Site Response Analysis)	3
CE 741	Geomechanics of Stress Deformation	3
CE 742	Deformation and Instability of Soils	3
CE 744	Foundation Engineering	3
CE 746	Soil Dynamics and Earthquake Engineering	3
CE 747	Geosynthetics in Geotechnical Engineering	3
CE 596	Special Topics in Water Resource and Environmental Engineering (Engineering Measurement and Data Analysis)	3
CE 594	Special Topics in Structures and Mechanics (Nondestructive Evaluation of Civil Infrastructure)	3
CE 759	Inelastic Behavior Of Construction Materials	3
MA 405	Introduction to Linear Algebra	3
MA 501	Advanced Mathematics for Engineers and Scientists I	3

MA 502	Advanced Mathematics for Engineers and Scientists II	3
CE 675	Civil Engineering Projects (Independent Study)	1-3

Transportation Materials and Systems Specialization

- 30-31 graduate credit hours
- 24/30 credits at 500-level or higher

Code	Title	Hours
Related Courses		
CE 501	Transportation Planning	3
CE 502	Traffic Operations	3
CE 503	Transportation System Design	3
CE 504	Airport Planning and Design	3
CE 509	Highway Safety	3
CE 594	Special Topics in Structures and Mechanics (Nondestructive Testing)	1-6
CE 595	Special Topics in Transportation Engineering (Asphalt/Bituminous Materials)	1-6
CE 595	Special Topics in Transportation Engineering (Sensors and Instrumentation)	1-6
CE 595	Special Topics in Transportation Engineering (Railroad Engineering)	1-6
CE 595	Special Topics in Transportation Engineering (Unconventional Intersection and Interchange Design)	1-6
CE 701	Urban Transportation Planning	3
CE 702	Traffic Flow Theory	3
CE 705	Transportation Systems Management	3
CE 706	Advanced Traffic Control	3
CE 707	Transportation Policy and Funding	3
CE 755	Highway Pavement Design	3
CE 757	Pavement Management Systems	3
CE 759	Inelastic Behavior Of Construction Materials	3
CE 795	Advanced Topics in Transportation Engineering (Transportation Economics)	1-3
CE 795	Advanced Topics in Transportation Engineering (Transportation Logistics)	1-3

Accelerated Bachelor's/Master's Degree Requirements

The Accelerated Bachelors/Master's (ABM) degree program allows exceptional undergraduate students at NC State an opportunity to complete the requirements for both the Bachelor's and Master's degrees at an accelerated pace. These undergraduate students may double count up to 12 credits and obtain a non-thesis Master's degree in the same field within 12 months of completing the Bachelor's degree, or obtain a thesis-based Master's degree in the same field within 18 months of completing the Bachelor's degree.

This degree program also provides an opportunity for the Directors of Graduate Programs (DGPs) at NC State to recruit rising juniors in their major to their graduate programs. However, permission to pursue an ABM degree program does not guarantee admission to the Graduate School. Admission is contingent on meeting eligibility requirements at the time of entering the graduate program.

CCEE Department ABM Admission

The CCEE department encourages excellent undergraduate students to obtain a master's degree in their chosen field of specialization within 2 to 3 semesters past BS graduation, through double counting up to 9 credit hours towards both bachelor's and master's degrees. This is referred to as the Accelerated Bachelor's/Master's (ABM) degree program. Following is the pathway for the ABM program.

Step 1 – Verify your eligibility for applying to the ABM program

- You must have completed at least 75 credit hours (this typically means junior standing)
    - If you are a transfer student, you must have completed at least two semesters at NCSU, earning a minimum of 24 credit hours
- You must not have already received a BS degree
- You must have an overall GPA # 3.5 and major GPA # 3.25

Step 2 – Apply for ABM by following the steps below

- Determine your area of interest from the list of graduate specialty areas on the next page.
- Talk to the ABM advisor in the specialty area (provided below), and agree on a tentative ABM Plan of Work (POW) that would suit your interests and satisfy the ABM requirements. A finalized ABM POW must be in place before completion of the BS degree.
- Submit an application at go.ncsu.edu/ccee-abm (https://applygrad.ncsu.edu/register/?id=4d63529c-6ad8-4680-9655-e4e49554ac56), which includes the tentative ABM POW.
    - The application will first be reviewed by the ABM advisor and a recommendation will be made to the department. The final determination will be made after a joint review by the directors of undergraduate and graduate programs, after which you will be notified.

Step 3 – While in the ABM program, maintain status by following the steps below:

- With the specialty area ABM advisor's help, prepare a tentative Graduate POW, that complements the Undergraduate POW.
    - Up to 9 credit hours can be double counted, they must be at the 500 level, and they must be selected from the approved list of courses in the specialty area (provided in the subsequent pages).
    - The (tentative) Graduate POW must be formally approved by the ABM advisor.
- It is your responsibility to ensure that both the Graduate POW and Undergraduate POW satisfy the respective master's and undergraduate degree requirements
- You must maintain an overall GPA # 3.5 and a major GPA # 3.25 until you enter the master's program.
- Only graduate courses with a grade # B can be double counted. Courses with a grade # B- cannot be counted towards the master's degree.
- Towards the end of your bachelor's program, you must formally apply to the master's program, per deadlines published by the graduate school. Note that the GRE may be waived for ABM students – consult with your ABM advisor. The application must include to include a

completed and signed ABM Plan of Work (https://grad.ncsu.edu/wp-content/uploads/2015/11/abm-plan-of-work.pdf).

- You must complete the master's degree within a time limit (12 months if MCE/MENE, 18 months if MSCE/MSENE), to take advantage of the double counting associated with the ABM. If you do not graduate within this time, you will be considered a regular master's student needing to take the full 30/31 graduate credits solely towards your master's degree.

Graduate Specialty Areas for ABM

Degrees earned will be distributed as: "Master of Civil Engineering" without specialization specifications.

- Computing and Systems
- Construction Engineering
- EWC – Air
- EWC – Environmental Process Engineering
- EWC – Water Resource and Coastal Engineering
- Geotechnical Engineering
- Structural Engineering and Mechanics
- Transportation Materials
- Transportation Systems

Allowable Courses by Specialty Area

Computing Systems

Code	Title	Hours
CE 536	Introduction to Numerical Methods for Civil Engineers	3
CE 537	Computer Methods and Applications	3
CE 538	Information Technology and Modeling	3
CE 590	Special Topics In Civil Engineering (Civil Engineering Systems)	1-6

Construction Engineering

Code	Title	Hours
CE 561	Construction Project Management	3
CE 562	Lean Construction Concepts and Methods	3
CE 564	Legal Aspects of Contracting	3
CE 565	Construction Safety Management	3
CE 567	Risk and Financial Management in Construction	3
CE 592	Special Topics in Construction Engineering	1-6

Other courses may selected and approved in conjunction with the academic committee, examples include but are not subject to:

CE 515	Advanced Strength of Materials	
CE 522	Theory and Design Of Prestressed Concrete	
CE 523	Theory and Behavior Of Steel Structures	
CE 524	Analysis and Design Of Masonry Structures	
CE 548	Engineering Properties Of Soils I	

EWC – Air

Code	Title	Hours
CE 576	Engineering Principles Of Air Pollution Control [*]	3
CE 578	Energy and Climate [*]	3
CE 579	Principles of Air Quality Engineering [*]	3

EWC – Environmental Process eNGINEERING

Code	Title	Hours
CE 571	Physical Principles of Environmental Engineering	3
CE 573	Biological Principles of Environmental Engineering	3
CE 574	Chemical Principles of Environmental Engineering	3
CE 577	Engineering Principles Of Solid Waste Management [*]	3
CE 578	Energy and Climate [*]	3
CE 596	Special Topics in Water Resource and Environmental Engineering (Global Sanitation) [*]	1-6

EWC – Water Resources, Coastal

Code	Title	Hours
CE 581	Fluid Mechanics in Natural Environments	3
CE 583	Engineering Aspects Of Coastal Processes	3
CE 584	Hydraulics Of Ground Water	3
CE 586	Engineering Hydrology	3
CE 588	Water Resources Engineering [*]	3
CE 596	Special Topics in Water Resource and Environmental Engineering (Coastal Hydrodynamics) [*]	1-6
CE 596	Special Topics in Water Resource and Environmental Engineering (Coastal Modeling)	1-6
CE 596	Special Topics in Water Resource and Environmental Engineering (Surface Water Quality Modeling)	1-6

Geotechnical Engineering

Code	Title	Hours
CE 548	Engineering Properties Of Soils I	3
CE 584	Hydraulics Of Ground Water	3
CE 593	Special Topics in Geotechnical Engineering (Dynamics of Soils and Foundations)	1-3

Other courses may selected and approved in conjunction with the academic committee, examples include but are not subject to:

CE 515	Advanced Strength of Materials	
CE 526	Finite Element Method in Structural Engineering	
CE 577	Engineering Principles Of Solid Waste Management	

Structural Engineering and Mechanics

Code	Title	Hours
CE 515	Advanced Strength of Materials	3
CE 522	Theory and Design Of Prestressed Concrete	3
CE 523	Theory and Behavior Of Steel Structures	3
CE 524	Analysis and Design Of Masonry Structures	3
CE 525	Advanced Structural Analysis	3
CE 526	Finite Element Method in Structural Engineering	3
CE 527	Structural Dynamics	3
CE 528	Structural Design in Wood	3
CE 529	FRP Strengthening and Repair of Concrete Structures	3
CE 530	Properties of Concrete and Advanced Cement-Based Composites	3

Transportation Materials

Code	Title	Hours
CE 515	Advanced Strength of Materials	3
CE 530	Properties of Concrete and Advanced Cement-Based Composites	3
CE 548	Engineering Properties Of Soils I	3
CE 595	Special Topics in Transportation Engineering (A - Asphalt and Bituminous Materials)	1-6

Transportation Systems

Code	Title	Hours
CE 501	Transportation Planning [*]	3
CE 502	Traffic Operations [*]	3
CE 503	Transportation System Design [*]	3
CE 504	Airport Planning and Design	3
CE 505	Railroad System Planning, Design, and Operation	3
CE 509	Highway Safety	3

[*] This course is not a prerequisite but recommended to be completed prior to enrollment.

Faculty

Full Professors

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Joel Casey Dietrich

Jacqueline Gibson

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