

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 | Counts towards |
|---|--|-------|----------------|
| 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) | | |

CE 7XX Complex adaptive 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 3

MA/CSC 583 Introduction to Parallel Computing 3

MA 584 Numerical Solution of Partial Differential Equations-- Finite Difference Methods 3

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| 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 | Counts towards |
|---|---|-------|----------------|
| 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 | | |

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|------------------------------|---|---|
| CE 503 | Highway 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 | Highway 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 | |

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| ISE 510 | Applied Engineering Economy | |
| ISE 562 | Simulation Modeling | |
| ST 515 | Experimental Statistics for Engineers I | |
| ST 516 | Experimental Statistics For Engineers II | |
| EGR 590 | Special Topics in Engineering (Environmental Compliance for Facilities for 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 | Counts towards |
|--------|--|-------|----------------|
| 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 | Counts towards |
|--------|--|-------|----------------|
| CE 675 | Civil Engineering Projects (Independent Study) | 3 | |

Total Hours 3

Structural Engineering and Mechanics Specialization

| Code | Title | Hours | Counts towards |
|---------------------|---|-------|----------------|
| Core Courses | | | |
| CE 515 | Advanced Strength of Materials | 3 | |
| CE 526 | Finite Element Method in Structural Engineering | 3 | |

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|--------|---------------------|---|
| CE 527 | Structural Dynamics | 3 |
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Select one of the following SEM Behavior and Design courses: 3

| | | |
|--------|---|--|
| CE 522 | Theory and Design Of Prestressed Concrete | |
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| CE 523 | Theory and Behavior Of Steel Structures | |
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|--------|---|--|
| CE 524 | Analysis and Design Of Masonry Structures | |
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|--------|---------------------------|--|
| CE 528 | Structural Design in Wood | |
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|--------|---|--|
| CE 529 | FRP Strengthening and Repair of Concrete Structures | |
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|--------|--|--|
| CE 726 | Advanced Theory Of Concrete Structures | |
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|--------|---|--|
| CE 794 | Advanced Topics in Structures and Mechanics | |
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Select two of the following additional SEM courses: 6

| | | |
|--------|------------------------------|--|
| CE 525 | Advanced Structural Analysis | |
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| CE 721 | Matrix and Finite Element Structural Analysis | |
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|--------|---|--|
| CE 530 | Properties of Concrete and Advanced Cement-Based Composites | |
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|--------|--------------|--|
| CE 714 | Stress Waves | |
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|--------|--|--|
| CE 718 | Constitutive Modeling of Engineering Materials | |
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|--------|--|--|
| CE 730 | Mechanics and Failure of Quasi-Brittle Materials | |
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|--------|------------------------------|--|
| CE 723 | Advanced Structural Dynamics | |
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|--------|---|--|
| CE 724 | Probabilistic Methods Of Structural Engineering | |
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|--------|---|--|
| 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 | Counts towards |
|--------|---|-------|----------------|
| 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 | |

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|--------|---|-----|
| 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 |

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| 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 | Counts towards |
|------------------------|------------------------------------|-------|----------------|
| Related Courses | | | |
| CE 501 | Transportation Systems Engineering | 3 | |

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|--------|---|-----|
| CE 502 | Traffic Operations | 3 |
| CE 503 | Highway Design | 3 |
| CE 504 | Airport Planning and Design | 3 |
| CE 506 | Transportation Engineering Data Collection and Analysis | 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 | Intelligent Transportation Systems | 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 |

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|--------|--|-----|
| 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 | Counts towards |
|--------|---|-------|----------------|
| CE 536 | Introduction to Numerical Methods for Civil Engineers | | |
| CE 537 | Computer Methods and Applications | | |
| CE 538 | Information Technology and Modeling | | |
| CE 590 | Special Topics In Civil Engineering (Civil Engineering Systems) | | |

Construction Engineering

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

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 | | |
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EWC – Air

| Code | Title | Hours | Counts towards |
|--------|---|-------|----------------|
| CE 576 | Engineering Principles Of Air Pollution Control * | | |
| CE 578 | Energy and Climate * | | |
| CE 579 | Principles of Air Quality Engineering * | | |

EWC – Environmental Process eENGINEERING

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

EWC – Water Resources, Coastal

| Code | Title | Hours | Counts towards |
|--------|--|-------|----------------|
| CE 581 | Fluid Mechanics in Natural Environments | | |
| CE 583 | Engineering Aspects Of Coastal Processes | | |
| CE 584 | Hydraulics Of Ground Water | | |
| CE 586 | Engineering Hydrology | | |

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|--------|---|
| CE 588 | Water Resources Engineering * |
| CE 596 | Special Topics in Water Resource and Environmental Engineering (Coastal Hydrodynamics) * |
| CE 596 | Special Topics in Water Resource and Environmental Engineering (Coastal Modeling) |
| CE 596 | Special Topics in Water Resource and Environmental Engineering (Surface Water Quality Modeling) |

Geotechnical Engineering

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

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

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|--------|--|
| 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 | Counts towards |
|--------|--------------------------------|-------|----------------|
| CE 515 | Advanced Strength of Materials | | |

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|--------|---|
| 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 525 | Advanced Structural Analysis |
| CE 526 | Finite Element Method in Structural Engineering |
| CE 527 | Structural Dynamics |
| CE 528 | Structural Design in Wood |
| CE 529 | FRP Strengthening and Repair of Concrete Structures |
| CE 530 | Properties of Concrete and Advanced Cement-Based Composites |

Transportation Materials

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

Transportation Systems

| Code | Title | Hours | Counts towards |
|--------|--------------------------------------|-------|----------------|
| CE 501 | Transportation Systems Engineering * | | |

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|--------|---|
| CE 502 | Traffic Operations * |
| CE 503 | Highway Design * |
| CE 504 | Airport Planning and Design |
| CE 505 | Railroad System Planning, Design, and Operation |
| CE 509 | Highway Safety |

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

Faculty

Associate Professors

Ghadir Haikal

Full Professors

Jacqueline MacDonald Gibson