Program Objectives of the M.S. in Civil Engineering are:

1. Graduates of the M.S. program will have the technical competence to be successful in the chosen area of study in civil engineering professional practice or research.
2. Graduates of the M.S. program will have the skills to undertake technically sound analysis independently and present their work at professional meetings or publish their work in scholarly journals.
3. Graduates of the M.S. program will have the technical competence to successfully undertake further advanced study at the doctoral level in civil engineering or a related area, and pursue lifelong learning through professional education.

Student Learning Outcomes are:

Students of the MS program in Civil Engineering will be able to:

1. Demonstrate clear understanding of the chosen area of emphasis in civil engineering covered in course material in the graduate program.
2. Apply advanced methods in the development solutions in the chosen area of emphasis in civil engineering.
3. Make professional presentations or write scholarly manuscripts worthy of publication in peer reviewed journals.

WATER/ENVIRONMENTAL AREA

Essential Student Learning Objectives for Water/Environmental Graduate (MS) Students
Students will have advanced level knowledge on environmental chemistry, transport and quantitative methods

Semester 1 (10 hours of coursework)
Core courses to build breadth
CEE6520 –Open Channel Hydraulics
CEE 6610 – Environmental Chemistry
Quantitative methods (e.g. CEE6430 – Probabilistic Methods)
CEE6910 – CEE Graduate Seminar (1 hour)

Semester 2 (9 hours of coursework)
Two CEE Courses to build depth in research area
One CEE or non-CEE Course to perform inter-disciplinary work in the area of research
Note:
- Plan of Study is completed before the end of Semester 2.
- Advisory Committee is setup.
- Candidate presents research proposal to Advisory Committee for approval and revision
- Candidate should have taken 1 hour of CEE6910 by Semester 2

Semester 3 (6 hours)
One CEE or non-CEE course in relevant area of research
CEE6990 – Research and Thesis (3 hours)
Note:
- Candidate's research work should be initiated by Semester 3

Semester 4 (6 hours)
One CEE or non-CEE course in relevant area of research
CEE6990 – Research and Thesis (3 hours)
Note:
- Candidate applies for graduation with graduate school
- Candidate presents draft of thesis to Advisory Committee for comment/revisions
- Candidate schedules a date for comprehensive exam and oral defense of thesis on or before the deadline set by graduate school

Electives Courses to build Depth and Support Area of Research:
CEE 6420 Fluvial Hydraulics
CEE 6440 Hydrometeorology
CEE 6710-20 Environmental Engineering Unit Operations and Processes
CEE 6750 Water Quality Modeling
CEE 7310 Hazardous Waste Remediation in Groundwater and Soil
GEOG 5510 Theory of GIS I
GEOG 5511 Theory of GIS II
GEOG 5620 Principles of GIS

GEOL 5330 Environmental Geology
GEOL 5410 Remote Sensing (4 Cr)
GEOL 5710 Hydrogeology
GEOL 5720 Advanced Hydrogeology
ME (ECE) 6200 Linear Systems Analysis (Kalman Filtering)
ME (ECE) 6260 State Estimation and System Identification
ME 6850 (ECE 6620) Fuzzy Logic Control Systems
ME 5740 Transport Phenomena
CHE 5660 Applied Mathematics in Chemical Engineering
MATH 5210-20 Numerical Analysis I-II
MATH 5470-80 Probability and Statistics I-II (for those weak in Stats for CEE6430)
MATH 6170-80 Experimental Design I-II

STRUCTURAL ENGINEERING AREA

Essential Student Learning Objectives for Structures Graduate Students
Students will have advanced level knowledge in the areas of structural analysis, behavior of structures, and design of structures with concrete, steel or masonry.

Typical Sequence of Coursework and Research
Core Courses:
(1) CEE 6930 – Theory of Elasticity
(2) CEE 7610 – Finite Element Analysis I
Note: To be taken as offered (preferably early in the program)

Flow Chart:
Semester 1
Coursework:
- Three CEE courses to build breadth. One of the three should be, if available, CEE 6930 (of the core courses) that is a prerequsitie to CEE 7610 (another core course).
- CEE 6910 – CEE Graduate Seminar (1hr)

Research Objectives:
- Begin scheduled discussions of research and initiate literature review if possible
- Formulate four semester plan for completion of graduate studies
- Become familiar with (and begin to plan for) grad requirements (committee formation, committee meetings, thesis layout, important dates, etc.)

Semester 2
Coursework:
- Two CEE courses to build depth in research area. One should be CEE 7610 which is a core course.
- One CEE or non-CEE course complimentary to research area

Research Objectives:
- Plan of Study is complete
- Advisory Committee is setup
- Candidate presents research proposal to Advisory Committee
- Candidate should have taken CEE 6910

Semester 3
Coursework:
- One CEE or non-CEE course complimentary to research area
- CEE 6990 – Research and Thesis (3 hours)

Research Objectives:
- Research work is initiated and significantly underway

Semester 4
Coursework:
- One CEE or non-CEE course complimentary to research area

- CEE 6990 – Research and Thesis (3 hours)

Research Objectives:

- Candidate applies for graduation
- Candidate presents draft thesis to Advisory Committee
- Candidate schedules a date for comprehensive exam (Ph.D.) and/or oral defense of thesis

Elective Courses to Build Depth and Support Area of Research

CEE 4130 (5130).Matrix and Finite Element Methods.
CEE (ME) 4160 (5160).Experimental Stress Analysis.
CEE (ME) 4190 (5190).Advanced Mechanics of Materials.
CEE 4350 (5350).Advanced Structural Design.
CEE 4360 (5360).Advanced Topics in Structural Concrete Design.
CEE 4380 (5380).Bridge Design.
CEE 4700 (5700).Masonry Design.

CEE 6100.Advanced Computer Applications in Civil Engineering.
CEE (ME) 6360.Introduction to Continuum Mechanics.
CEE (ME) 6370.Vibrations of Continuous Media.
CEE 6810.Advanced Structural Mechanics.
CEE 6900.Special Problems.
CEE 6930 (ME 6840).Theory of Elasticity.

CEE 7100.Advanced Computational Methods in Engineering.
CEE 7360.Advanced Topics in Prestressed Concrete Design.
CEE 7510 (ME 7600).Theory of Plates and Shells.
CEE (ME) 7610.Finite Element Analysis I.
CEE (ME) 7640.Theory of Inelastic Material Behavior.
CEE 7710 (ME 7660). Fracture Mechanics.
CEE 7720 (ME 7670).Fiber-Reinforced Composite Materials.
CEE 7810.Structural Dynamics.
CEE 7820 (ME 7680).Theory of Elastic Stability.
CEE 7910/11/12. Study of Current Literature

TRANSPORTATION/MATERIALS AREA

Essential Student Learning Objectives for Transportation/Materials Graduate Students
Students will have advanced level knowledge in the areas of cement-based materials or transportation planning and operations.

Typical Sequence of Coursework and Research
Core Courses – Transportation Planning and Operations Concentration:
(1) CEE 6410 – Traffic Control Systems
(2) CEE 6470 – Transportation Demand Analysis
(3) Graduate level course in probability and statistics
Note: To be taken as offered (preferably early in the program)

Core Courses – Materials Concentration:
(1) CEE 6300 - Multiscale Analysis of Concrete
(2) CEE 5190 – Advanced Mechanics of Material or graduate level course in probability and statistics
Note: To be taken as offered (preferably early in the program)

Semester Activities
Semester 1
Coursework:
- Three graduate level courses to build capability in transportation engineering, materials, and statistics.
- CEE 6910 – CEE Graduate Seminar (1hour)

Research Objectives:
- Begin scheduled discussions of research and initiate literature review if possible
- Formulate four semester plan for completion of MS graduate program
- Become familiar with program requirements and begin to plan for MS Advisory Committee formation, important dates, etc.

Semester 2
Coursework:
- Three graduate level courses to build capability in transportation engineering, materials, and statistics.

Research Objectives:
- Program of Study should be completed
- Advisory Committee should be setup
- Candidate presents research proposal to MS Advisory Committee

Semester 3
Coursework:
- Two graduate level courses. Courses could be from transportation engineering, materials, statistics, or geography
- CEE 6990 – Research and Thesis (3 hours)

Research Objectives:

- Significant progress on research work
- Begin documentation of research

Semester 4
Coursework:
- One CEE or non-CEE course complimentary to research area
- CEE 6990 – Research and Thesis (3 hours)

Research Objectives:
- Complete documentation of research
- Present draft thesis to Advisory Committee
- Schedule a date for oral defense of thesis

Elective Courses to Build Depth and Support in Area of Research

CEE 5600 - Civil Engineering Materials II
CEE 5610 - Pavement Design
CEE 5630 - Traffic Engineering
CEE 5640 - Highway Engineering
CEE 5660 - Transportation Planning
CEE 5930 - Noise Control
CEE 5990 - Special Problems
GEOG 5510 - Theory of GIS I
GEOG 5511 - Theory of GIS II
GEOG 5850 - Advanced GIS
MATH 5470 - Probability and Statistics I
MATH 5480 - Probability and Statistics II
ME 5480 - Microstructure Analysis

CEE 6310 - Bituminous Materials
CEE 6330 - Advanced Pavement Design
CEE 6450 - Geometric Design of Roadways
CEE 6460 - Transportation Safety Engineering
CEE 6900 - Special Problems
ISE 6200 - Statistical Methods for Engineers
MATH 6070 - Applied Linear Statistical Methods I
MATH 6080 - Applied Linear Statistical Methods II
MATH 6170 - Experimental Design I
MATH 6180 - Experimental Design II

CEE 7410 - Advanced Travel Demand Modeling
CEE 7420 - Public Transportation
CEE 7450 - Advanced Topics in Concrete Durability
CEE 7970 - Selected Topics
CEE 7980 - Directed Study

STRUCTURAL MECHANICS AREA

Essential Student Learning Objectives for Transportation Graduate Students

Students will have advanced level knowledge in the area of theoretical and computational mechanics, statics and dynamics behavior of continuum media.

Typical Sequence of Coursework and Research

Core Courses – Structural Mechanics:

(1) CEE 6930 – Theory of Elasticity
(2) CEE 7610 – Finite Element Analysis I
(3) MATH 5510 – Advanced Math for Engineers

Semester Activities

Semester 1

Coursework:

- Three graduate level courses to build breadth in the area of mechanics. One should be CEE6930 that is pre-requisite to CEE7610 (both are core courses)
- CEE 6910 – CEE Graduate Seminar (1hour)

Research Objectives:

- Begin scheduled discussions of research and initiate literature review if possible
- Formulate four semester plan for completion of MS graduate program
- Become familiar with program requirements and begin to plan for MS Advisory Committee formation, important dates, etc.

Semester 2

Coursework:

- Three graduate level courses related to research area. One should be CEE 7610 (core course)

Research Objectives:

- Program of Study should be completed
- Advisory Committee should be setup
- Candidate presents research proposal to MS Advisory Committee

Semester 3

Coursework:

- One graduate level course complementary to research area.
- CEE 6990 – Research and Thesis (3 hours)

Research Objectives:

- Significant progress on research work
- Begin documentation of research

Semester 4

Coursework:

- One graduate level course complimentary to research area.
- CEE 6990 – Research and Thesis (3 hours)

Research Objectives:

- Complete documentation of research
- Present draft thesis to Advisory Committee
- Schedule a date for oral defense of thesis

Elective Courses to Build Depth and Support in Area of Research

CEE 5130 - Matrix and Finite Element Methods
CEE 5160 - Experimental Stress Analysis
CEE 5190 - Advanced Mechanics of Materials
CEE 5700 - Masonry Design
CEE 5930 - Noise Control
MATH 5510 - Advanced Math for Engineers
ME 5480 - Microstructure Analysis
ME 5510 - Aerodynamics
CEE 6100 - Advance Computer Applications in Civil Engineering
CEE 6640 - Intermediate Fluid Mechanics
CEE 6360 - Introduction to Continuum Mechanics
CEE 6370 Vibrations of Continuous Media
CEE 6810 - Advanced Structural Mechanics
CEE 6900 - Special Problems: Energy and Variational Methods in Mechanics
CEE 6980 - Directed Study
CEE 6930 - Theory of Elasticity
CEE 7100 - Advanced Computational Methods in Engineering
CEE 7220 - Finite Element Analysis for Flow in Porous Media
CEE 7510 - Theory of Plates and Shells
CEE 7610 - Finite Element Analysis I
CEE 7620 - Finite Element Analysis II
CEE 7640 - Theory of Inelastic Material Behavior
CEE 7650 – Continuum Theories of Materials
CEE 7710 - Fracture Mechanics
CEE 7720 - Fiber-Reinforced Composite Materials
CEE 7810 - Structural Dynamics
CEE 7820 - Theory of Elastic Stability
CEE 7910/11/12 – Study of Current Literature