Department of Civil and Environmental Engineering

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Gary Schafran, Chair

Isao Ishibashi, Graduate Program Director
Jaewan Yoon, Graduate Program Director - Fall 2015

Department Description

The Civil and Environmental Engineering Department offers an ABET accredited Bachelor of Science (B.S.) degrees in Civil Engineering. At the graduate level the department offers a variety of master and doctoral degrees as listed below. The graduate programs are structured to accommodate both the full-time and part-time students. Most of the graduate courses are offered in evenings, and many are offered as televised courses. The available specialty areas are coastal, geotechnical, structural, transportation and water resources engineering in Civil Engineering and a variety of sub-fields in Environmental Engineering. Distance learning master’s degree programs in coastal engineering and environmental engineering are available with allowed transfer credits.

List of Degrees and Certificates

- Master of Engineering - Civil Engineering
- Master of Science, Engineering - Civil Engineering
- Master of Engineering - Environmental Engineering
- Master of Science, Engineering - Environmental Engineering
- Doctor of Philosophy, Engineering - Civil and Environmental Engineering
- Doctor of Engineering - Civil and Environmental Engineering
- Graduate Certificate in Coastal Engineering
- Advanced Engineering Certificate in Energy Systems

Master’s Degrees

In this rapidly changing technological world, graduate degrees are highly desirable and most often master’s degrees are required to hold professional civil and environmental engineering positions in the industry, and in federal, state and municipal government agencies. The department’s graduate programs are designed to educate the technological leaders of the future in civil and environmental engineering, and are structured to accommodate both full-time and part-time students. The specialty areas include coastal, geotechnical, structural, transportation and water resources engineering in civil engineering, and sub-fields in environmental engineering including water quality, water and wastewater treatment, hydrologic processes, water resources, environmental engineering microbiology, air quality, hazardous and solid waste, and pollution prevention. For additional information please request a departmental handbook from the graduate program director.

Admission Information

Civil and Environmental master degrees applicant must have a bachelor’s degree, preferably, in civil or environmental engineering with a strong background in mathematics and physical sciences. Each applicant must submit an essay of 500 words or less describing personal and academic goals, professional objectives, preparation for graduate study, and how the chosen program will help the applicant achieve these goals and objectives. Two letters of recommendation must be submitted from former or current professors, or employment supervisors. Regular admission to a master’s program generally requires an undergraduate GPA of 3.0 or higher on a 4.0 scale. Applicants with a lower undergraduate GPA may be considered for regular or provisional admission on the basis of successful engineering work experience or other credentials demonstrating potential for success in the graduate program. The submission of Graduate Record Examination (GRE) are required unless the applicant holds an ABET accredited engineering degree from an institution in the USA. TOEFL (or IELTS) are required for all applicants whose mother languages are not English unless their BS degrees are from USA institutions. Provisional admission may also be possible for applicants with a bachelor’s degree in a field other than the applicant’s intended graduate program. In such cases there will be pre-requisite course requirements. Provisional admission may be given to those applicants who do not hold a bachelor’s degree in civil or environmental engineering; however these students will be required to complete undergraduate course work in addition to the graduate program requirements. Potential prerequisite courses are listed below.

Potential Prerequisite Courses for M.S. & M.E., Civil Engineering (other than Transportation Engineering Emphasis):

- MATH 211 Calculus I 4
- MATH 212 Calculus II 4
- MATH 307 Ordinary Differential Equations 3
- MATH 312 Calculus III 4
- PHYS 231N University Physics 4
- PHYS 232N University Physics 4
- CS 150 Problem Solving and Programming I 4
- or CEE 305 Civil and Environmental Computations
- CEE 204 Statics 3
- MAE 205 Dynamics 3
- CEE 220 Mechanics of Deformable Bodies 3
- CEE 310 Structures I 3
- CEE 323 Soil Mechanics 3
- CEE 330 Hydromechanics 3
- CEE 340 Hydraulics and Water Resources 3
- CEE 410 Concrete Design I 3

Potential Prerequisites Courses for M.S. & M.E., Civil Engineering (Transportation Engineering Emphasis):

- MATH 211 Calculus I 4
- MATH 212 Calculus II 4
- MATH 312 Calculus III 4
- STAT 306 Introductory Statistics 3
- PHYS 231N University Physics 4
- PHYS 232N University Physics 4
- CS 150 Problem Solving and Programming I 4
- or CEE 305 Civil and Environmental Computations

Potential Prerequisite Courses for M.S. & M.E., Environmental Engineering:

- MATH 211 Calculus I 4
- MATH 212 Calculus II 4
- MATH 307 Ordinary Differential Equations 3
- MATH 312 Calculus III 4
- PHYS 231N University Physics 4
- PHYS 232N University Physics 4
- CHEM 121N Foundations of Chemistry I Lecture 3
- CHEM 122N Foundations of Chemistry I Laboratory 1
- CHEM 123N Foundations of Chemistry II Lecture 3
- CS 150 Problem Solving and Programming I 4
or CEE 305  Civil and Environmental Computations  
CEE 330  Hydromechanics  
CEE 340  Hydraulics and Water Resources  
CEE 350  Environmental Pollution and Control  

Civil Engineering and Environmental Engineering  
Graduate Course Requirements (except Transportation Engineering Emphasis):  
The graduate courses applicable towards a master’s degree in the Department of Civil and Environmental Engineering are grouped into various categories listed below. The required number of the credit hours from these categories for the Master of Science (M.S.) and the Master of Engineering (M.E.) degrees in Civil Engineering (except transportation engineering concentration) and in Environmental Engineering are summarized in Table CEE-1 and CEE-2, respectively. Note that for the M.S. option students must pass an oral thesis defense examination. For the M.E. option project students must pass an oral project defense examination. For the M.E. course option, student must pass an oral (for civil engineering) or written (for environmental engineering) comprehensive examination at the end of all course work.

Category A – Upper level courses in Civil Engineering  
CEE 710  Structural Dynamics  
CEE 711  Finite Element Analysis  
CEE 712  Advanced Reinforced Concrete  
CEE 713  Prestressed Concrete  
CEE 714  Advanced Structural Analysis  
CEE 715  Engineering Optimization I  
CEE 717  Bridge Structures Design  
CEE 719  Inelastic Structures  
CEE 720  Structural Stability  
CEE 721  Plates  
CEE 722  Cluster Parallel Computing  
CEE 723  Seismic Design of Steel Structures  
CEE 724  Retrofitting Methods for Bridges and Buildings  
CEE 730  Advanced Foundation Engineering  
CEE 731  Advanced Soil Mechanics  
CEE 732  Engineering Behavior of Soils  
CEE 733  Soil Dynamics  
CEE 741  Open Channel Flow *  
CEE 747  Groundwater Flow *  
CEE 761  Water Resources Processes and Analysis Methods *  
CEE 770  Transportation Safety  
CEE 771  Transportation Operations II  
CEE 772  Intelligent Transportation Systems  
CEE 773  Transportation Planning  
CEE 774  Transportation Network Flow Models  
CEE 775  Computational Methods for Transportation Systems  
CEE 776  Simulation in Transportation Networks  
CEE 782  Design of Coastal Structures  
CEE 783  Tidal Hydraulics in the Estuarine and Coastal Environment  
CEE 787  Dredging and Beach Engineering  
CEE 788  Coastal Hydrodynamics and Sediment Processes *  
CEE 789  Computational Environmental Fluid Dynamics  

Category B – Upper level courses in Environmental Engineering  
CEE 650  Pollution Prevention  
CEE 659  Carbon-Free Clean Energy  
CEE 700  Civil and Environmental Engineering Experimental Design #  
CEE 741  Open Channel Flow *  
CEE 747  Groundwater Flow *  
CEE 751  Physicochemical Treatment Processes  
CEE 752  Biological Wastewater Treatment  
CEE 753  Advanced Processes for Water and Wastewater Treatment  
CEE 754  Environmental Engineering Microbiology  
CEE 755  Water Quality Management  
CEE 756  Water Quality Modeling  
CEE 761  Water Resources Processes and Analysis Methods *  
CEE 762  Aquatic Chemistry in Environmental Engineering  
CEE 788  Coastal Hydrodynamics and Sediment Processes *  

Category C – Lower level courses in Civil & Environmental Engineering  
CEE 514  Masonry Structures Design  
CEE 515  Steel Structures Design  
CEE 516  Wood Structures Design  
CEE 530  Foundation Engineering  
CEE 531  Earth Structures Design with Geosynthetics  
CEE 532  Introduction to Earthquake Engineering  
CEE 540  Hydraulic Engineering  
CEE 546  Urban Stormwater Hydrology  
CEE 547  Groundwater Hydraulics  
CEE 550  Water Distribution and Wastewater Collection System Design  
CEE 552  Air Quality  
CEE 554  Hazardous Waste Treatment  
CEE 558  Sustainable Development  
CEE 559  Biofuels Engineering  
CEE 560  Advanced Analytical Techniques in Environmental Engineering  
CEE 570  Transportation Fundamentals  
CEE 571  Transportation Operations I  
CEE 582  Introduction to Coastal Engineering  

Category D – Other graduate courses  
Graduate level courses offered from other departments. These courses must be related to the program of study and must be approved by the student’s academic advisor.  

MATH or STAT Category  
CEE 700 Civil and Environmental Engineering Experimental Design(#) or a graduate level MATH or STAT course.  
*  Double listings in A and B categories.  
#  Double listings in B and STAT categories.

Table CEE-1. Required Course Distributions for M.S. and M.E., Civil Engineering (except for Transportation Engineering Emphasis)  
M.S. - Thesis Option
**Civil Engineering Graduate Course Requirements**

(in Transportation Engineering Emphasis):

The department offers Master of Science (M.S.) and Master of Engineering (M.E.) degrees in Civil Engineering with concentration in Transportation Engineering. Table CEE-3 summarizes the requirements for the M.S. and M.E. degrees in the Transportation Engineering concentration. Note that for the M.S. option students must pass an oral thesis defense examination. For the M.E. project option students must pass an oral project defense examination. For the M.E. course option, student must pass an oral comprehensive examination at the end of all course work.

### Table CEE-3. Required Course Distributions for M.S. and M.E., Civil Engineering – Transportation Engineering Emphasis

#### M.S. - Thesis Option

<table>
<thead>
<tr>
<th>Category</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core Courses</td>
<td>9</td>
</tr>
<tr>
<td>Upper-Level Transportation Electives</td>
<td>3</td>
</tr>
<tr>
<td>Graduate Statistic Course</td>
<td>3</td>
</tr>
<tr>
<td>Other Electives</td>
<td>9</td>
</tr>
<tr>
<td>Thesis</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>30*</td>
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</table>

#### M.E. - Project Option

<table>
<thead>
<tr>
<th>Category</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core Courses</td>
<td>9</td>
</tr>
<tr>
<td>Upper-Level Transportation Electives</td>
<td>3</td>
</tr>
<tr>
<td>Graduate Statistic Course</td>
<td>3</td>
</tr>
<tr>
<td>Other Electives</td>
<td>12</td>
</tr>
<tr>
<td>Project</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>30*</td>
</tr>
</tbody>
</table>

#### M.E. - Course Option

<table>
<thead>
<tr>
<th>Category</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core Courses</td>
<td>9</td>
</tr>
<tr>
<td>Upper-Level Transportation Electives</td>
<td>6</td>
</tr>
<tr>
<td>Graduate Statistic Course</td>
<td>3</td>
</tr>
<tr>
<td>Other Electives</td>
<td>12</td>
</tr>
<tr>
<td>Total</td>
<td>30**</td>
</tr>
</tbody>
</table>

* For M.S. and M.E. Project options, no more than 9 credit hours can be at 500 level.

** For M.E. Course option, no more than 12 credit hours can be at 500 level.

### Courses in Transportation Engineering Emphasis

#### Core Courses

- CEE 570 Transportation Fundamentals
- CEE 571 Transportation Operations I
- CEE 773 Transportation Planning

#### Upper-level Transportation Electives

- CEE 770 Transportation Safety
- CEE 771 Transportation Operations II
- CEE 772 Intelligent Transportation Systems
- CEE 774 Transportation Network Flow Models
- CEE 775 Computational Methods for Transportation Systems
- CEE 776 Simulation in Transportation Networks

#### Statistics Course

- CEE 700 Civil and Environmental Engineering Experimental Design
### Other Elective Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE 770</td>
<td>Transportation Safety</td>
</tr>
<tr>
<td>CEE 771</td>
<td>Transportation Operations II</td>
</tr>
<tr>
<td>CEE 772</td>
<td>Intelligent Transportation Systems</td>
</tr>
<tr>
<td>CEE 774</td>
<td>Transportation Network Flow Models</td>
</tr>
<tr>
<td>CEE 775</td>
<td>Computational Methods for Transportation Systems</td>
</tr>
<tr>
<td>CEE 776</td>
<td>Simulation in Transportation Networks</td>
</tr>
</tbody>
</table>

and other approved electives - see table below

### Thesis/Project

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE 699</td>
<td>Thesis</td>
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<tr>
<td>CEE 698</td>
<td>Master’s Project</td>
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</table>

### Other Approved Electives

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE 552</td>
<td>Air Quality</td>
<td>3</td>
</tr>
<tr>
<td>CEE 558</td>
<td>Sustainable Development</td>
<td>3</td>
</tr>
<tr>
<td>CEE 715</td>
<td>Engineering Optimization I</td>
<td>3</td>
</tr>
<tr>
<td>ECON 502</td>
<td>Transportation Economics</td>
<td>3</td>
</tr>
<tr>
<td>ENMA 600</td>
<td>Cost Estimating and Financial Analysis</td>
<td>3</td>
</tr>
<tr>
<td>ENMA 603</td>
<td>Operations Research</td>
<td>3</td>
</tr>
<tr>
<td>ENMA 717</td>
<td>Cost Engineering</td>
<td>3</td>
</tr>
<tr>
<td>ENMA 724</td>
<td>Risk Analysis</td>
<td>3</td>
</tr>
<tr>
<td>MSIM 601</td>
<td>Introduction to Modeling and Simulation</td>
<td>3</td>
</tr>
<tr>
<td>MSIM 603</td>
<td>Simulation Design</td>
<td>3</td>
</tr>
<tr>
<td>MSIM 751</td>
<td>Advanced Analysis for Modeling and Simulation</td>
<td>3</td>
</tr>
<tr>
<td>PADM 633</td>
<td>Methods of Urban Planning</td>
<td>3</td>
</tr>
<tr>
<td>PADM 634</td>
<td>Regional Planning</td>
<td>3</td>
</tr>
<tr>
<td>PADM 721</td>
<td>Transportation Policy</td>
<td>3</td>
</tr>
<tr>
<td>PORT 611</td>
<td>International Maritime Transport</td>
<td>3</td>
</tr>
<tr>
<td>PORT 612</td>
<td>Port Operations and Management</td>
<td>3</td>
</tr>
<tr>
<td>PORT 614</td>
<td>Port Planning and Economics</td>
<td>3</td>
</tr>
<tr>
<td>PSYC 870</td>
<td>Human Factors Psychology</td>
<td>3</td>
</tr>
<tr>
<td>STAT 531</td>
<td>Theory of Statistics</td>
<td>3</td>
</tr>
<tr>
<td>STAT 532</td>
<td>Sampling Theory</td>
<td>3</td>
</tr>
<tr>
<td>STAT 535</td>
<td>Design and Analysis of Experiments</td>
<td>3</td>
</tr>
<tr>
<td>STAT 537</td>
<td>Applied Regression and Time Series Analysis</td>
<td>3</td>
</tr>
<tr>
<td>STAT 549</td>
<td>Nonparametric Statistics</td>
<td>3</td>
</tr>
</tbody>
</table>

### Doctor of Philosophy, Engineering

Doctoral degrees in civil engineering and environmental engineering are required for college-level teaching and employment in research institutions. Many leading industries and agencies also seek well-trained doctoral graduates. The specialty areas include coastal, geotechnical, structural, transportation, and water resources engineering in Civil Engineering and a variety of sub-fields in Environmental Engineering including water quality, water and wastewater treatment, hydrologic processes, water resources, environmental engineering microbiology, air quality, hazardous and solid waste, and pollution prevention.

### Admission Requirements

A master’s degree or equivalent in engineering or a related field is required for admission to the Ph.D. program; however, exceptionally well qualified students can be admitted to Ph.D. program directly without a master’s degree. Each applicant must submit an essay of 500 words or less describing personal and academic goals, professional objectives, preparation for graduate study, and how the chosen program will help the applicant achieve these goals and objectives. Two letters of recommendation are required. At least one of these must be submitted from former or current professors, and one could be from employment supervisor. Regular admission to a Ph.D. program generally requires a GPA of 3.5 or higher on a 4.0 scale in their master program. Applicants with a lower GPA may be considered for regular or provisional admission on the basis of successful engineering work experience or other credentials demonstrating potential for success in the Ph.D. program. Submission of GRE scores is required except for applicants who hold an ABET accredited engineering degree from an institution in the USA or a graduate engineering degree from an institution of which the undergraduate degree is ABET accredited in the USA. TOEFL (or IELTS) are required for all applicants whose mother languages are not English unless their master (or BS) degrees are from USA institutions.

### Degree Requirements

Ph.D. program requires minimum 24 credits of course works and 24 credit hours of dissertation research work. Three fifths (3/5) of these courses (15 credit hours) shall be from 800-level courses as required by the University.