Environmental Engineering (ENEG)

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Degree Conferred:
Master of Science in Environmental Engineering, M.S.En.E (ENEG)

The Master of Science in Environmental Engineering is a multi-discipline degree program designed for students from a multitude of academic areas.

Program Objectives: The objectives of the M.S.En.E. program are to prepare graduates for careers in environmental engineering practice with government agencies, engineering firms, or industries and to provide a foundation for continued study at the post-masters level.

Primary Areas of Faculty Research:
- Water treatment and distribution
- Waste-water collection and treatment
- Soil and groundwater remediation
- Surface and ground water quality
- Environmental and hydrologic modeling
- Animal waste management
- Non-point source pollution prevention
- Watershed management
- Reactor design and biomass energy
- Energy systems including heat transfer
- Thermodynamics and liquid-vapor phase change
- Bacterial tracers for evaluating movement through fractured subsurface strata

Admission Criteria: In addition to the requirements of the Graduate School, the following are the minimum criteria for admission to the M.S.En.E. degree program:
- GPA: 3.00 or higher
- GRE Scores: No less than 302 (verbal + quantitative) and 3.5 analytical writing

Degree Requirements: Accreditation of the M.S.En.E. program by the Accreditation Board for Engineering and Technology (ABET) requires candidates to fulfill some baccalaureate degree requirements in non-engineering and engineering undergraduate courses. Candidates must complete the State of Arkansas Minimum Core Curriculum for baccalaureate degrees, which includes American History, Government, English Composition, Higher Mathematics, Science, Humanities & Fine Arts, and Social Sciences. Regardless of undergraduate discipline, each candidate must complete a number of basic undergraduate engineering courses. In general, graduates of ABET accredited engineering programs will have already completed most, if not all, of these courses. However, the prerequisite requirements for graduates of programs other than engineering can be quite significant. All M.S.En.E. degree candidates, regardless of previous degree status, must demonstrate completion of the Basic Engineering Education and Environmental Engineering breadth requirements listed below. The cumulative grade-point average on basic engineering education and environmental engineering breadth courses must be at least 2.70.

Candidates who do not possess a degree from a program accredited by ABET must also satisfy the basic level ABET accreditation requirement. These include completion of no less than 32 credit hours of university-level mathematics and science, and 48 credit hours of approved engineering topics. Candidates must also demonstrate to the satisfaction of the student’s graduate study committee, that he/she possess the abilities and characteristics required of graduates from ABET accredited engineering programs. This shall include the completion of a course that concentrates on a major design project which results in the production of a design report or other design product as appropriate. The design project must build on and require engineering knowledge and skills from previous course work and must incorporate engineering standards and realistic constraints. The course selected to satisfy this requirement is subject to the approval of the student’s graduate study committee.

Exceptions to these degree requirements may be requested by means of a petition outlining the reasons for the exceptions and presenting an alternate plan for completing the program. The petition shall be subject to the approval of the student’s graduate study committee, program faculty, and the Director of the M.S.En.E. program. Credit for courses taken at another institution is subject to the approval of the Director of the M.S.En.E. program. In particular, advanced engineering courses (3000, 4000, and 5000-level at the University of Arkansas) normally will not be accepted for transfer from institutions or degree programs that are not accredited by ABET.

I. Basic Engineering Education Requirements

General Education Recommended Courses

<table>
<thead>
<tr>
<th>Humanities/Social Science (15 hours)</th>
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</thead>
<tbody>
<tr>
<td>Acceptable to Undergraduate Program</td>
</tr>
<tr>
<td>American History or American Government (3 hours)</td>
</tr>
<tr>
<td>HIST 2003 History of the American People to 1877 (ACTS Equivalency = HIST 2113) (Sp, Su, Fa)</td>
</tr>
<tr>
<td>HIST 213 History of the American People, 1877 to Present (ACTS Equivalency = HIST 2123) (Sp, Su, Fa)</td>
</tr>
<tr>
<td>English Composition (6 hours)</td>
</tr>
</tbody>
</table>

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ENGL 1013 & ENGL 1023 Composition I (ACTS Equivalency = ENGL 1013) (Sp, Su, Fa) and Composition II (ACTS Equivalency = ENGL 1023) (Sp, Su, Fa)

Mathematics and Basic Science Recommended Courses

Calculus Through Differential Equations (15 hours)

MATH 2554 Calculus I (ACTS Equivalency = MATH 2405) (Sp, Su, Fa)
MATH 2564 Calculus II (ACTS Equivalency = MATH 2505) (Sp, Su, Fa)
MATH 2574 Calculus III (ACTS Equivalency = MATH 2603) (Sp, Su, Fa)
or MATH 2584 & MATH 3083 Differential Equations and Laplace Transform (Sp, Su, Fa) and Linear Algebra (Sp, Su, Fa)

Statistics and Probability (3 hours)

INEG 2313 Applied Probability and Statistics for Engineers I (Sp, Fa)
STAT 3013 Introduction to Probability and Statistics (Sp, Su, Fa)

General Chemistry (3 hours)

CHEM 1113 University Chemistry for Engineers I (Su, Fa)
CHEM 1123 & CHEM 1121 Laboratory University Chemistry II (ACTS Equivalency = CHEM 1004 Lecture) (Sp, Su, Fa) and University Chemistry II Laboratory (ACTS Equivalency = CHEM 1004 Lab) (Sp, Su, Fa)

University Physics (calculus based) (4 hours)

PHYS 2054 University Physics I (ACTS Equivalency = PHYS 2034) (Sp, Su, Fa)

Microbiology (4 hours)

BIOL 2013 General Microbiology (ACTS Equivalency = BIOL 2004 Lecture) (Sp, Su, Fa)
& BIOL 2011L and General Microbiology Laboratory (ACTS Equivalency = BIOL 2004 Lab) (Sp, Su, Fa)

Organic Chemistry (4 hours)

CHEM 3504 Physical Chemistry I (Fa)
CHEM 3603 Organic Chemistry I (Su, Fa)
& CHEM 3601L and Organic Chemistry I Laboratory (Su, Fa)

Earth Science (2 hours)

GEOL 1113 General Geology (ACTS Equivalency = GEOL 1114 Lecture) (Sp, Su, Fa)
CSES 2203 Soil Science (Fa)

General Engineering Education (20-21 hours)

Required Topics and Recommended Courses

Statics & Mechanics of Materials (5-6 hours)

MEEG 2003 Statics (Sp, Su, Fa)
& MEEG 3013 and Mechanics of Materials (Sp, Su, Fa) (Sp, Su, Fa)
CVEG 2014 Fundamentals of Mechanics for Civil Engineers (Sp, Su, Fa)
& CVEG 2011L and Fundamentals of Mechanics for Civil Engineers - Lab (Sp, Su, Fa)

Hydraulics or Fluid Mechanics (3 hours)

CVEG 3213 Hydraulics (Sp, Fa)
CHEG 2133 Fluid Mechanics (Sp, Su, Fa)
MEEG 3503 Mechanics of Fluids (Su, Fa)

Engineering Economics (3 hours)

CVEG 3022 Public Works Economics (Sp, Fa)
INEG 2413 Engineering Economic Analysis (Sp, Fa)

Thermodynamics (3 hours)

CHEG 3143 Heat Transport (Sp, Fa)
MEEG 2403 Thermodynamics (Sp, Su, Fa)

Environmental Engineering (3 hours)

CVEG 3243 Environmental Engineering (Sp, Fa)

Environmental Engineering Design (3 hours)

CVEG 4243 Environmental Engineering Design (Sp, Fa)

Total Hours 79-80

II. Environmental Engineering Breadth Requirements (18 hours)

Required Topics and Recommended Courses

BENG 3723 Unit Operations in Biological Engineering (Sp) 3
BENG 3933 3
BENG 4113 Risk Analysis for Biological Systems (Odd years, Fa) 3
BENG 4133 3
BENG 4903 3
BENG 4813 Senior Biological Engineering Design I (Fa) 3
& BENG 4822 Senior Biological Engineering Design II (Sp) 3
CHEG 3333 Chemical Engineering Reactor Design (Sp, Su) 3
CHEG 4813 Chemical Process Safety (Fa) 3
CVEG 3133 Soil Mechanics (Sp, Fa) 3
CVEG 4203 Environmental Regulations and Permits (Fa) 3
CVEG 4243 Environmental Engineering Design (Sp, Fa) 3
CVEG 3223 Hydrology (Sp, Fa) 3
CVEG 4513 Construction Management (Sp, Fa) 3
CVEG 4273 Open Channel Flow (Sp) 3
INEG 4223 Occupational Safety and Health Standards (Irregular) 3

Total Hours 45

III. Environmental Engineering (M.S.En.E) Graduate Degree Requirements

The M.S.En.E. program requirements for graduate-level work include the minimum requirements of the Graduate School and requirements that are specific to the M.S.En.E. program:

1. No more than nine graduate credit hours presented for the M.S.En.E. degree may be 4000-level.
2. The minimum acceptable grade for each course presented for the degree is a "C" (2.0 grade points).
3. The cumulative grade-point average on all graduate courses presented for the degree must be at least 3.00.
4. A comprehensive examination that will include either a defense of the candidate’s thesis or a presentation and discussion of the candidate’s master’s report.
5. Required courses listed below.

Required Courses

CVEG 5203 Water Chemistry (Sp) 3
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CVEG 5213</td>
<td>Water Treatment &amp; Distribution System Design (Sp)</td>
<td>3</td>
</tr>
<tr>
<td>CVEG 5214</td>
<td>Advanced Wastewater Process Design and Analysis (Fa)</td>
<td>4</td>
</tr>
<tr>
<td>CVEG 5233</td>
<td>Microbiology for Environmental Engineers (Irregular)</td>
<td>3</td>
</tr>
<tr>
<td>CVEG 5273</td>
<td>Open Channel Flow (Irregular)</td>
<td>3</td>
</tr>
</tbody>
</table>

**Thesis Option:** 30 hours of graduate-level course work, approved by the student’s graduate adviser, including satisfactorily completing a total of 24 hours of graded graduate course work and six hours of research resulting in a written master’s thesis.

**Non-Thesis Option:** 33 hours of graduate-level course work, which must be approved by the student’s graduate adviser, including satisfactorily completing a total of 30 hours of graded graduate course work and three hours of independent study resulting in a written master’s report.