Interdisciplinary Engineering (PhD)

Prospective students should use this checklist (http://www.uab.edu/graduate/images/acrobat/checklist/IE.pdf) to obtain specific admissions requirements on how to apply to Graduate School.

Concentrations offered: Advanced Safety Engineering, Computational Engineering, Environmental Health & Safety Engineering, Information Engineering, and Integrated Engineering

Faculty: Because of the interdisciplinary nature of this program, participating faculty come from various areas of engineering and science. A complete listing of all participating faculty can be found online (http://www.uab.edu/engineering/home/degrees-cert/197-degree-certificates/765-graduate-faculty).

Program Objectives

For more than a decade, research-focused centers at UAB and elsewhere have brought together expertise from many disciplines to solve problems. This same problem-solving approach is now finding its way into academic programs through the implementation of interdisciplinary graduate education. It is the premise of these interdisciplinary programs that students must be educated in several areas to remain competitive and have successful careers whether they choose to stay in academia or work in industry. Industries are particularly interested in graduate education that emphasizes breadth of knowledge as well as depth in a particular field. Today’s professional must be able to change, focus, and move between disciplines in order to keep up with rapid market shifts and technological advances.

The PhD program in Interdisciplinary Engineering takes advantage of unique resources and strengths at UAB. This program fosters interdisciplinary interactions between the School of Engineering, the School of Medicine, the Collat School of Business, The School of Public Health, Health Professions and the Collage of Arts and Sciences. Students in Interdisciplinary Engineering will have the opportunity to develop a plan of study and research topic which incorporates coursework and faculty expertise from two or more of these disciplines.

Students enrolled in the Interdisciplinary Engineering PhD program will gain the skills necessary to succeed as independent and productive investigators in multidisciplinary analysis and design, with applications over a wide spectrum of science, engineering, health, and medical fields. The interdisciplinary program will:

- Provide a rigorous academic curriculum including coursework in two or more disciplines
- Provide collaborative interactions with students and faculty from a variety of disciplines
- Provide unique opportunities for interdisciplinary research
- Facilitate continued development of high quality research programs supported by external funding.

Five tracks are available in the Interdisciplinary Engineering PhD program:

- Advanced Safety Engineering
- Computational Engineering (http://www.uab.edu/engineering/home/degrees-cert/197-degree-certificates/33-cme)
- Environmental Health & Safety Engineering (http://www.uab.edu/engineering/home/degrees-cert/197-degree-certificates/601-ehse)
- Information Engineering (http://www.uab.edu/engineering/home/209-news/1231-information-engineering)
- Integrated Systems

Admission Requirements

Students applying to the Interdisciplinary Engineering PhD program have completed an undergraduate degree in a supporting field and must submit official transcripts and Graduate Record Exam (GRE) scores with their application. In general, GRE quantitative and verbal scores of at least 50th percentile and a minimum undergraduate or master’s degree grade point average of 3.0 on a 4.0 point scale are required for admission. Students for whom English is a second language should have a score no less than 100 on the Internet Based TOEFL (Test of English as a Foreign Language). In the essay submitted by the student as part of the application package, the applicant is encouraged to identify his/her research interest. This information will help the admission committee in decision making. The Interdisciplinary Engineering Admissions Committee reviews all complete applications submitted and will make all admission decisions.

Degree Requirements

The PhD in Interdisciplinary Engineering promotes a research-based curriculum. A minimum number of core courses will be required of all students in the program, with additional coursework directed by the student’s graduate research committee based on the student’s area of interest. Committee members must be selected from at least two different disciplines, and the planned curriculum must result in cross-training in two or more disciplines.

Students entering the PhD program with a baccalaureate degree must, in keeping with UAB Graduate School Policies, complete at least 48 hours of coursework prior to admission to candidacy. Up to 16 credits of the 48 can be as non-dissertation research credits, and up to 10 credits can be as lab rotations, seminars, or directed study credits. Students entering the PhD program with a Master’s degree in a related field, MD, DMD, etc., must complete at least 27 credit hours of coursework prior to candidacy. Up to 6 credits of the 27 can be non-dissertation research credits, and up to 6 credits can be as lab rotations, seminars, or directed study credits.

The UAB Graduate School also requires that students complete at least two semesters as a full time student in candidacy or accumulate at least 24 credits in research hours or coursework in candidacy prior to granting of degree. At least 24 hours of dissertation research will be required for PhD program graduates in Interdisciplinary Engineering.

All students in the IE program must complete the following core courses:

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Hours</th>
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<tbody>
<tr>
<td>EGR 710 Intro to Interdisciplinary EGR</td>
<td>3</td>
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<tr>
<td>EGR 711 Methodology for IEGR Research</td>
<td>3</td>
</tr>
<tr>
<td>Journal Club - 4 enrollments of 1 hour each</td>
<td>4</td>
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<tr>
<td>EGR 796 Journal Club in Interdisciplinary Engineering</td>
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</tbody>
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A Comprehensive Exam is required of all doctoral candidates. The exam may include both written and oral components and will include presentation of the student’s dissertation proposal. The exam will be administered by the student’s graduate research committee. Upon successful completion of the Qualifying Exam and completion of at least
48 hours of coursework (in keeping with Graduate School requirements), a student is admitted into doctoral candidacy.

A dissertation showing the ability to conduct, analyze, and defend independent research must be prepared on a topic in the research field of interest. Dissertation results are expected to be submitted for refereed scholarly publication. The dissertation must comply with UAB dissertation preparation guidelines. When the dissertation has been completed, doctoral candidates will present and defend their work before their graduate research committee and the public. This defense will constitute the candidate’s final exam. The results of the examination must be reported to the Graduate School at least six weeks before the commencement at which the degree is to be conferred.

Program Resources

High Performance Computing (HPC), High Fidelity Simulations (HFS), Tera/Penta-scale data mining/management/analysis, image processing, feature extraction, pattern recognition, and geometry reconstruction are the key enabling technologies in addressing 21st century science and engineering problems. These technologies are necessary for the development of cross-cutting tool kits to enhance research and development in interacting biological, chemical, medical, physical, business and finance, and engineering phenomena associated with interdisciplinary engineering research.

In response to this need, UAB has made a strategic investment in establishing an Enabling Technology Laboratory (Experience Lab). The Experience Lab provides software and hardware infrastructure and support for high performance parallel and distributed computing, numerical tools, information technology-based computing environments, and computational simulation to UAB and Southern Research (SR) researchers. In collaboration with UAB interdisciplinary investigators, the Experience Lab has established 6.0+ Teraflops high performance computing clusters, including an IBM Blue gene with 2048 processors and a visualization infrastructure with stereoscopic and high resolution large displays. Both hardware and software essential for interdisciplinary engineering research can be fully supported by this equipment.

A 3D laser scanner necessary for full three-dimensional modeling and reconstruction was acquired by a collaborative team including faculty from the Schools of Engineering and Medicine. Access to this and other equipment, as well as clinical data available in the Radiology, Orthopedic, and Surgery departments and the School of Dentistry will be available to the students and interdisciplinary teams of faculty members participating in the interdisciplinary engineering program. These teams have already been collaborating on several sponsored and un-sponsored research programs in both computational engineering and environmental health and safety engineering tracks.

Additional equipment to facilitate engineering research is available to Interdisciplinary Engineering students through the laboratories of the Departments of Materials Science & Engineering, Mechanical Engineering, Electrical & Computer Engineering, Biomedical Engineering, and Civil, Construction, & Environmental Engineering. Additional equipment is available to students through participating faculty from other Schools across campus.

Program Curriculum

The PhD in Interdisciplinary Engineering program encompasses a broad spectrum of possible fields of expertise in engineering and science, and as such, curriculums vary depending on the specific fields of research and background of the student.

Computational Engineering (CME) Track

The CME track of the Interdisciplinary Engineering program takes advantage of UAB's diversified Schools of Engineering, Public Health, Dentistry and Medicine and College of Arts and Sciences to produce PhD candidates cross-trained in computational engineering from a variety of disciplines. The program provides students an in-depth foundation and innovation opportunities in interdisciplinary aspects of enabling technologies - geometry generation and computer-aided geometry design, mesh generation and adaptation, visualization, augmented reality and virtual reality, image processing and pattern recognition, design optimization, computational fluid dynamics, computational structural mechanics, high performance and parallel computing, and molecular dynamics applicable to disparate time and length-scale problems encountered in biomedical, biology, medicine and surgery, physics and biophysics, manufacturing, combustion, aeronautics and astronautics, and energy, environment and power.

Environmental Health and Safety Engineering (EHSE) Track

The EHSE track of the Interdisciplinary Engineering program takes advantage of UAB's diversified Schools of Engineering and Public Health, and College of Arts and Sciences as well as the nationally renowned health sciences center, to produce PhD candidates cross-trained in public health, environmental, and safety engineering from a variety of disciplines. The program provides students with an understanding of basic mechanisms through which agents alter environmental, human, and ecosystem health, and the skills needed to evaluate and implement remediation for environmental problems, in the context of engineering and public health.

Coursework

In addition to EGR 710, EGR 711, and EGR 796, course selection is based on the research and career goals of the student, and curricula will vary between students. Students are guided by their faculty mentor (committee chair) and a graduate study committee composed of faculty representing an interdisciplinary team in the student's area of research interest. The coursework must include courses from at least two disciplines.

This work will be completed under the guidance of the student's faculty mentor (graduate study committee chair). An approved 6 hour internship may be substituted for 6 of the required dissertation research hours. Non-dissertation Research and Dissertation Research hours will be taken through the department of the student's faculty mentor.

Additional Information

Deadline for Entry Term(s):  
Fall: July 1  
Spring: November 1,  
Summer: April 1

Deadline for All Application Materials to be in the Graduate School Office:  
Six weeks before term begins

Number of Evaluation Forms Required:  
Three
| Entrance Tests | GRE General Test (TOEFL is also required for international applicants whose native language is not English.) |

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