Interdisciplinary Engineering (PhD)

Program Objectives

Today’s professional must constantly change, adapt, focus, and navigate among disciplines to keep up with rapid market shifts and technological advances. Because of these market trends, industries are particularly interested in interdisciplinary graduate education that emphasize both breadth of knowledge and depth in a particular field. The premise of interdisciplinary programs is that students must be educated in multiple related subject areas to remain competitive and have successful careers in academia or industry. The Ph.D. Program in Interdisciplinary Engineering provides a rigorous academic curriculum including course work in two or more disciplines and unique opportunities for interdisciplinary research.

The Interdisciplinary Engineering Ph.D. Program draws upon strengths of the five departments in the School of Engineering: Biomedical Engineering, Civil Construction and Environmental Engineering, Electrical and Computer Engineering, Mechanical Engineering and Materials Science and Engineering. Students enrolled in the Interdisciplinary Engineering Ph.D. 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. Areas of emphasis in the Interdisciplinary Engineering Ph.D. program include advanced safety engineering; computational engineering, modeling and simulation; environmental health and environmental engineering; biomedical imaging; neural engineering; information engineering and engineering management; and integrated systems and systems engineering. The program provides unique opportunities for interdisciplinary research and fosters interdisciplinary collaborative interactions between students and faculty in the School of Engineering, the Schools of Business, Medicine, and Public Health and the College of Arts and Sciences. Interdisciplinary Engineering students have opportunities to develop a plan of study and a dissertation research topic that incorporates course work and faculty expertise from two or more disciplines across UAB.

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.

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 Immersive Experience Laboratory (IXL). The IXL 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 IXL 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 unsponsored 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.

Admission Requirements

- Undergraduate or graduate degree in Engineering. Applicants who do not meet this criterion but who have an outstanding academic record in a related field, may be admitted on probation. Students admitted in this category will be required to complete a sequence of undergraduate courses (including prerequisites as appropriate) in addition to the normal requirements of the IE PhD degree
- Minimum 3.0 on a 4.0 scale on most recent degree
- GRE score in 50th percentile or higher (Institution code – 1856. Applicable for the GRE and TOEFL only)
- For applicants whose first language is not English, TOEFL score of 80 (with a minimum score of 20 on each subsection) or higher OR IELTS score of 6.5 or higher (Institution code – 1856. Applicable for the GRE and TOEFL only)
- Personal statement identifying research interest
- CV/Résumé
- 3 recommendations from academic or professional contact
- Official transcripts from each institution where college credit was received to be mailed to:

  UAB Graduate School
LHL G03; 1720 2nd Avenue South
Birmingham, AL 35294-0013

Institutions can also submit official transcripts electronically by choosing University of Alabama at Birmingham – Graduate Admissions or using the email gradschool@uab.edu.

**International Requirements**

- For applicants whose first language is not English, TOEFL score of 80 or higher (with a minimum score of 20 on each subsection) OR IELTS score of 6.5 or higher (*Institution code – 1856. Applicable for the GRE and TOEFL only*)
- Financial Affidavit of Support
- Immigration documentation if currently residing in the US

**Additional Information**

<table>
<thead>
<tr>
<th>Deadline for Entry Term(s):</th>
<th>Fall: August 1; Spring: December 1; Summer: May 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deadline for All Application Materials to be in the Graduate School Office:</td>
<td>Six weeks before term begins</td>
</tr>
<tr>
<td>Number of Evaluation Forms Required:</td>
<td>Three</td>
</tr>
<tr>
<td>Entrance Tests</td>
<td>GRE General Test (TOEFL is also required for international applicants whose native language is not English.)</td>
</tr>
<tr>
<td>Application Fee</td>
<td>Domestic &amp; green card holders: $50; International: $60</td>
</tr>
</tbody>
</table>

**Contacts**

Dr. Timothy M. Wick  
Graduate Program Director  
Senior Associate Dean  
tmwick@uab.edu @uab.edu (littlefield@uab.edu)

Kristy Barlow  
Director of Academic Programs  
School of Engineering Dean’s Office  
kbarlow@uab.edu (sswatson@uab.edu)

**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 (with a minimum of 2 faculty from the School of Engineering), 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 10 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>
</tr>
</thead>
<tbody>
<tr>
<td>EGR 710 Intro to Interdisciplinary EGR</td>
<td>3</td>
</tr>
<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>
</tr>
<tr>
<td>EGR 796 Journal Club in Interdisciplinary Engineering</td>
<td></td>
</tr>
<tr>
<td>GRD 717 Principles of Scientific Integrity</td>
<td>3</td>
</tr>
</tbody>
</table>

A Comprehensive Exam is required of all doctoral candidates. The exam includes 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 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.

**Coursework**

In addition to EGR 710 Intro to Interdisciplinary EGR, EGR 711 Methodology for IEGR Research, EGR 796 Journal Club in Interdisciplinary Engineering, and GRD 717 Principles of Scientific Integrity, 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.

**Important Program Information**

- The Interdisciplinary Engineering Program is not fully online.
- Students in the program can be part time for the first 30 credit hours and some or all of these coursework hours can be online.
- After 30 hours, the student is expected to be full-time and spend at least one year in residency at UAB working on their dissertation, preferably in 3 consecutive terms.
• Students will take a minimum of 6 hours of cross-disciplinary training, which is defined as courses taken outside of the School of Engineering. These courses must be approved by IE PhD Committee prior to registration.
• Students are expected to publish and present during their PhD program.