Want to feel good about what you do?

Think Engineering.

Engineers understand the “Big Picture” — that there are people behind the molecules and mechanisms they study and that working in teams with professionals across disciplines can generate solutions that change lives. Tackling the grand challenges society faces is what engineers do, who they are. And, this is the goal of Notre Dame Engineering.

Here world-class faculty and cutting-edge research facilities focus on the technical, being the best and most proficient you can be. As a Catholic university, we also highlight values because work without a focus on ethics is just work and has no heart. It might contribute to the bottom line, but it doesn’t always contribute to the greater good. It doesn’t always make a real difference. We promise that what you’ll experience in the College of Engineering at Notre Dame will always be authentically technical, totally personal, and incredibly life-changing.
Other things you need to know about Notre Dame Engineering:

- We provide a strong liberal arts core, focusing on oral and written communications.
- You have a year to select a major. (You don’t have to decide now.)
- Most of our courses are taught by regular faculty, not graduate assistants.
- While your engineering courses will range in size from large lectures to independent research, our average student/faculty ratio is 11 to 1.
- Hands-on research opportunities are not just for graduate students; many of our undergraduates work on cutting-edge projects.
- We offer a two-course engineering-business practices sequence taught by engineers who are also business professionals.
- You have a choice of several international study programs, many of which won’t impact your graduation date.
- Community service is a big part of who we are, and you can choose to participate close to home or internationally.
- We offer dual degree options in conjunction with liberal arts, science, and business so you can personalize your degree.
- More than 95% of our engineering graduates complete their degree requirements in four years.
- Our track record with internship and full-time career placement for our students is very strong.
- Many of our graduates have also secured placement in the best graduate schools in the country.
Specific Courses, Yes, but You’ve Got Options

All Notre Dame students have a year before they have to declare a major. However, students who indicate they are interested in engineering should include specific courses in their first-year selections, such as the EG10111/10112 two-course sequence. This sequence gives you the strongest foundation for further engineering studies. So be sure to talk to your adviser before making a final selection.

EG10111/10112 introduces basic engineering principles. The courses are taught in sections of 40-45 students, so that all students benefit from the attention of course instructors. Student assistants are also a vital part of the classes, helping answer technical questions and easing the adjustment from high school to college.

During the first year you will work in teams and individually on a series of projects through which you’ll begin to use engineering principles and practice. That’s in class. Outside of class, faculty and engineering student assistants are ready to help with study sessions, research tips, and social events specifically for engineering students. You become part of a community on campus that extends to our global alumni community after your graduate.

Also important to remember is that the engineering program at Notre Dame lets you tailor your educational experience and your degree ... from your first year of studies through your senior design project. Our academic majors, minors, and concentrations; internships; international study experiences; and service opportunities have all been designed to help you succeed in a program that gives you options and lets you personalize your experience.

Earning Credit, Placement Transfer Credits

For the most accurate information about how placement or transfer credit is determined, check out the University’s Bulletin of Information at registrar.nd.edu/BOI/BOI.php

First Year of Studies — Engineering

Your first year in the College of Engineering may include the following courses*:

<table>
<thead>
<tr>
<th>Fall Semester</th>
<th>Course Credits</th>
<th>Spring Semester</th>
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<tbody>
<tr>
<td>University Seminar or Writing &amp; Rhetoric</td>
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<td>University Seminar or Writing &amp; Rhetoric</td>
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<tr>
<td>Calculus I</td>
<td>4</td>
<td>Calculus II</td>
<td>4</td>
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<tr>
<td>General Chemistry — Fundamental Principles</td>
<td>4</td>
<td>General Chemistry — Biological Processes or Tech Elective</td>
<td>3</td>
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<tr>
<td>Arts &amp; Letters Core Course</td>
<td>3</td>
<td>General Physics I</td>
<td>4</td>
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<tr>
<td>Introduction to Engineering Systems I (EG10111)</td>
<td>3</td>
<td>Introduction to Engineering Systems II (EG10112)</td>
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<td>Moreau First Year Experience</td>
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— Total 18                                — Total 18

* AP credit may affect your first-year course schedule.
The McCourtney Learning Center

nd.edu/~englearn

Located in Stinson-Remick Hall of Engineering, the McCourtney Learning Center is more than a classroom. It’s a blend of classroom, workshop, laboratory, computer workstation, and team project space. The initial purpose of the learning center was to support first-year engineering students, but it has become much more. With 10,100 sq. ft. of space, it offers plenty of room for undergraduates at all levels to work on a variety of projects.

All of the departments within the college have created courses that promote the interactive multidisciplinary learning that occurs within the learning center. So students are able to analyze, design, build, test, and communicate their findings to one another and to the faculty. In short, they learn to function like professional engineers do in industry.
Making New Materials One Molecule at a Time

We’ve mentioned that you can tailor your degree to your strengths and interests. One of the ways you can do this is through a concentration in materials science.

The Stone Age and Bronze Age were named because of the way these materials changed the world, and today is no different. Society continues to look for new and better materials to meet the different needs we have now. These new materials must be stronger, lighter, more flexible, more corrosion-resistant, and less expensive than existing ones in order to enable new and emerging technologies. These new materials will be the building blocks of tomorrow, impacting industries such as aerospace, automotive, biomaterials, chemical, electronics, energy, metals, and telecommunications.

Many of our undergraduates are already participating in high-profile materials research. They work with nationally known faculty throughout the college to develop novel materials for fuel cells, a new generation of semiconductors, biocatalytic membranes, tissue engineering, medical diagnostic devices, and pollution prevention and remediation.

Bioengineering Based in Traditional Majors

Because so many different industries employ “bio” technologies, bioengineering does not reside in just one department within the College of Engineering. This approach lets you develop a technically strong skill set through a traditional engineering major, while learning how to apply the theories of that field to a specific area of bioengineering — even one based in a different department.

For example, you can choose to minor in a “bio” area or pursue a degree concentration in bioengineering. Specialty areas within this field focus on chemical or mechanical engineering principles and include biomechanics, the study of motion and devices in the body; biomaterials, which studies living tissue as well as synthetic materials for use in implants; and bioinstrumentation, the development of electronics and measurement devices for diagnostic and treatment applications. With four of the five largest orthopedics companies in the world within a one-hour drive from Notre Dame, our students are able to take advantage of unique opportunities to interact with orthopedics professionals on campus and at these facilities as part of their research.
Electrical engineering, computer science, or computer engineering majors may choose to concentrate on **bioinformatics**. Often called computational biology, bioinformatics employs algorithms and mathematical methods to model and analyze biological behavior. It uses computers to mimic the movements and “thought patterns” of simple life forms in order to better understand, interpret, and predict real-life actions. Bioinformatics includes imaging technologies, which aid in medical diagnoses and treatment plans, as well as vision identification, sometimes called **biometrics**. In fact, students in the Department of Computer Science and Engineering have developed one of the largest databases of faces, for identification purposes, in the United States. Understanding the geological controls on natural environments and habitats, as well as the impact of human activities upon those environments, is a focus of several research facilities in the college. Our chemical, civil, and environmental engineering students work with biologists, chemists, and physicists in the field of **bioremediation**.

**Biology for Engineers: Setting the Stage for the Future**

Developing an understanding of the intricate nature of biological processes is as important from an engineering perspective as it is from a scientific one. That’s why the College of Engineering offers biology courses specific to engineering undergraduates interested in pursuing “bio” technologies. The first, Introduction to Bioengineering, highlights the everyday functions, growth, and interactions of cells, genetics, and living systems, especially in relation to problem-solving for medical applications. A fast-paced course, many students use it as a stepping stone to the wide range of bioengineering research opportunities offered throughout the college, particularly first-year students who would not normally have the opportunity to participate in hands-on research until the end of their sophomore year.

The follow-up course, Introduction to Cell and Tissue Engineering, covers the principles of cell and developmental biology that guide current practices in tissue engineering and regenerative medicine, including computational and quantitative analyses of cell-cell signaling and morphogenesis. Students in this course also study techniques involved in cultivating cells for recombinant protein production, the design of artificial organs, and regenerative therapeutics. Both courses can be applied to minors or concentrations, adding to the scope of your degree.
Customize Your Experience with a Minor
engineering.nd.edu/academics/undergraduatedegreeprograms

Expertise in a specialty area, as can be achieved through a minor, can be personally and professionally satisfying. The **minors offered by the College of Engineering require at least four courses (9 credit hours) past degree requirements** and include: bioengineering, computational engineering, energy engineering, energy studies, engineering corporate practice (MECP), environmental earth sciences, and resiliency and sustainability of engineered systems.

**Bioengineering minors** take a six-course sequence where they learn to use the tools of engineering analysis with the fundamentals of engineering and life sciences. Focused on living organisms, medical treatments, and biochemical pathways, the sequence provides insight into the design of medical and biological devices and processes. This minor also requires three foundational courses in bioengineering and cell biology, along with three courses specializing in areas such as biomaterials, biomechanics, biotransport/microdevices, tissue engineering and biomaterials, molecular and cellular bioengineering, bioinformatics, biomedical imaging and treatment, and environmental bioactivity and remediation.

If you have a strong interest in mathematical and computational tools, you could pursue the five-course minor in **computational engineering**. The range of courses offered across all our departments exposes you to the fundamentals of programming and numerical methods, experience and skills in computer usage, and knowledge of applications in different areas.

An **energy engineering minor**, also a five-course sequence, deepens your understanding of many aspects of energy — energy systems, combustion, gas turbines, electrochemical energy and storage, energy and climate, fuel cells, alternative energy devices and materials, electric machinery and power systems, and electric and hybrid vehicles.

The **energy studies minor**, offered through the Center for Sustainable Energy at Notre Dame, highlights the technical and ethical complexity of the energy challenge, presenting a survey of energy resources and the connection between energy use and global climate change. Students follow foundational courses with a one-credit seminar on energy policy, the environment, and society offered by the Center for Social Concerns, and a three-course sequence focusing on either a technical or non-technical aspect of the global energy situation.

An interdisciplinary minor, the **engineering corporate practice minor** encompasses the two-course Integrated Engineering and Business Practices sequence offered by the College of Engineering, an economics class taught by the College of Arts & Letters, and accountancy and finance courses in the Mendoza College of Business. It develops skills in the areas of business operations, accountancy, and finance.

The **environmental earth sciences minor** requires 16 credits in areas relevant to the Earth’s geology. It emphasizes the inter-relationships of geosystems and humans through courses in geology, geochemistry, geomicrobiology, mineralogy, and the impact of resource utilization.

The **resiliency and sustainability of engineered systems minor** requires a two-course sequence; three courses from an approved list of courses ranging from economics, sociology, political science, engineering, and architecture; and a one-credit capstone experience. The goal of the minor is to help students recognize the impact of their engineering decisions on the resiliency and sustainability of built and natural systems so that they will be adept at working with planners, decision makers, and the public after graduation.
Senior Design
Capstone projects from the ground up.

From the rigorous coursework involved with his major to fitting other activities into his busy schedule, Michael Thompson has faced a lot of challenges during his time at Notre Dame. “Engineering students work hard. It might look easier for us because one of the first, and most important, things we learn is how to take a difficult problem and break it down into solvable pieces.” For Thompson, those pieces included being a member of Liturgical Choir, playing interhall and intramural sports, undergraduate research, an internship at SpaceX, and using his helicopter pilot’s license every chance he could. His schedule has been so full that it seems inconceivable he’d still have time to study and prepare for the next step — graduate school for a degree in autonomous aerospace systems.

According to Thompson, although engineering is a lot of work, faculty are always accessible and willing to help. He says, “You also have a lot of fun and make a lot of friends because fellow students encourage one another rather than compete against each other, even in the senior design courses.”

Every senior in the College of Engineering is required to complete a capstone project. It’s a different challenge in each department, but all projects start from the ground up.

The Department of Aerospace and Mechanical Engineering takes that phrase literally. Its aerospace majors must design, build, and test a radio-controlled aircraft using the skills they have learned. For example, the aircraft student teams create must carry a specific payload, take-off on grass in no more than 300 ft., and return and land safely. All planes must also feature a fixed main wing, house an electric motor powered by a battery power pack, and include an internal cargo (an onboard microprocessor and digital radio control system with up to seven channels). Once in the air their plane must maintain velocity at a constant altitude and change altitude over a 100 ft. climb — all while transmitting data from the plane to a laptop on the ground, which analyzes flight performance. Not at all an easy “A.”

For information on all engineering capstone courses, visit engineering.nd.edu and check out each department’s site.
Investing in the Future
Dual degree. Singular focus.

Texas native Katrina Gonzales says, “I knew from a young age that I wanted to be an engineer.” Yet she also enjoyed other fields. A member of her high school’s speech and debate teams, she had interests in political science and economics. Because economics related to math and computer science well, Gonzales decided to pursue a dual degree. “I think it gives me a broader perspective, especially as I am planning on going into software development immediately after graduation, and maybe later going on to graduate school pivoting toward economics.”

While that might sound like two separate paths, Gonzales points out that there are always new technologies popping up, and her dual degree positions her well for the rapidly evolving digital world. Also serving her well will be what she considers the most important thing she has learned at Notre Dame — the skill of learning how to learn. “It doesn’t apply just to the tech industry but in taking new classes, stepping outside of your comfort zone, even accepting leadership positions. The ability to approach something new and understand how to tackle it one step at a time is one of the most valuable lessons I now carry with me.”

There certainly were new experiences in which Gonzales engaged at Notre Dame. She participated in two summer internships developing software: one with Amazon Robotics and one with Microsoft. She worked as a student researcher in the University’s mobile computing lab and competed in a series of hackathons. She has also served as president of the Notre Dame section of the Society of Women Engineers and has been active with interhall soccer and the women’s boxing team, where she participated in the annual Baraka Bouts.

Gonzales says it’s all about fit. “Notre Dame is full of interesting, curious, and passionate people. In the end the people you surround yourself with shape the person you become. So find the people that you click with and that challenge you — whether it’s to spend long nights studying or a few hours ice skating, or whatever you enjoy doing. Remember that there’s more to college [and life] than problem sets and essays, and that finding the balance is the best way to prepare for your future.”
Dual-degree Programs
engineering.nd.edu/academics/undergraduatedegreeprograms

Engineering students just like you are looking for an edge, something to set them apart from the other engineering students who will be looking for an internship, fellowship, entry to graduate school, or full-time position. One of the things that can set you apart is a dual degree. Yes, a dual degree means you’ll be here for five years instead of four, but it kind of makes you a double threat in the market. Want to learn more? Contact your undergraduate adviser, ideally during your first year on campus. That’s when you’ll have the most options to explore.

Engineering/Arts & Letters
Some students choose to enter the dual-degree program through the John J. Reilly Center in the College of Arts & Letters and the College of Engineering. You’re still looking at five years but you can earn a B.S. in any engineering discipline and a B.A. in any field within the College of Arts & Letters.

Qualified students may receive scholarship support from the John J. Reilly Endowed Scholarship program during their fifth year of study.

Engineering/Science
Engineering students who want to broaden their education with the more theoretical aspects of science may pursue a dual-degree program with the College of Science. You can design your own program such as computer science and mathematics, chemical engineering and chemistry, or mechanical engineering and biology. These five-year programs lead to two bachelor of science degrees, one in engineering and the other in a science field.

Engineering/M.B.A.
You can earn your M.B.A. while finishing your engineering degree. It starts by applying for admission to the M.B.A. program in your junior year, being accepted, then working very hard in your fourth and fifth years at the University. At the end of this program, you will have a bachelor of science degree from the College of Engineering and a Master of Business Administration (M.B.A.) from the Mendoza College of Business.

Financial aid for your M.B.A. year comes through the M.B.A. program and may be different than other aid.

Dual Enrollment in ESTEEM
Students who enter their senior year with less than two full-time semesters of study remaining may apply for early, dual enrollment in the Engineering, Science and Technology Entrepreneurship Excellence Master’s (ESTEEM) program, which focuses on entrepreneurship and business development in a technical context. This dual enrollment enables students to complete the ESTEEM program and enter the job market with an additional summer and one semester of study past the bachelor’s degree, rather than the two semesters and a summer of study typically required of ESTEEM program participants.
Business and Best Practices Program  
engineering.nd.edu/engbiz

The College of Engineering does more than offer business management training to its engineering undergraduates. Our Integrated Engineering and Business Practices Program incorporates business courses into the engineering curriculum. And what a difference it makes.

Our two-course sequence is designed to help you develop an understanding of the dynamics of corporate operations. You’ll learn financial basics, business strategy and planning, and core business processes. You’ll study current best practices, examine managerial styles and organizational climates, and discuss leadership trends in a continually changing business environment.

In addition to classroom discussion, the courses feature:
- guest speakers who are professional engineers and managers,
- business simulation programs,
- case studies,
- presentation skill development,
- and required student presentations.

This is even more important when you consider that an engineering degree, particularly when paired with a keen understanding of business processes, is very marketable and can be applied in any number of careers and industries. According to Forbes, engineering is the most common undergraduate degree among Fortune 500 CEOs.

You can develop even more business-related skills in accountancy and finance and deepen your understanding of the detailed economic issues that drive businesses and consumers with a Minor in Engineering Corporate Practice (MECP). The MECP builds on the courses in the Integrated Engineering and Business Practices Program. A popular minor, you’ll want to be sure to apply for MECP in your junior year as a limited number of students are accepted annually.
Waking up to Big Ben
International study opens a whole new world.

London, England, is a long way from Brighton, Mich., but Mary Kate O’Leary felt right at home. A chemical engineering major who is also pursuing a concentration in biomolecular engineering, O’Leary spent a summer studying in London. Her classes — sustainability and business fundamentals — took a lot of her time but she was still able to explore the city and much of Europe with her classmates.

“The sustainability class was an eye-opener,” she says. “We learned how much humans consume and studied some of the most pressing issues society will be facing. We also got a firsthand look at what London is doing to reduce pollution.”

As demanding as the course work was, O’Leary felt that the people — her fellow students as well as those she met during her visit — helped her learn the most. From the real-life problem solving involved in international travel to the discussions about Brexit or just catching the tube at King’s Cross Station. “It reminded me that we’re all on the same ‘spacecraft Earth’ as Father Hesburgh said — that everything we do affects others. That’s what I want to take with me into my career, the idea of environmental responsibility for the betterment of humankind.”

O’Leary describes her time in London as “the best experience of her life,” which is quite a statement considering she is heavily involved in a local tutoring program, the Right to Life Club, the ChemE car team, campus ministry, Welsh Family Hall council, and intramural sports. But it’s all part of her philosophy of travelling, learning, and growing together.
See the World — Study Abroad
engineering.nd.edu/academics/studyabroad

Ever hear your parents or grandparents say, “The world is smaller than it used to be”? Well, it is — at least in terms of connectivity and communication. But there are still things that you won’t understand until you experience them, like living and studying in another country. Notre Dame and the College of Engineering encourage students to live and study abroad.

At some engineering schools, it is difficult to have an international study experience and still graduate in four years. At Notre Dame, nearly 60% of our engineering undergraduates participate in an international study experience while staying on their academic track. These study-abroad experiences, which are available during your junior year and summer breaks, develop leadership skills and a better understanding of different cultures as you interact with local residents, explore historical sites, and tour engineering facilities.

As a Notre Dame student, you can participate in any of the international study programs offered through the University. However, the programs offered through the College of Engineering have been specifically developed so that they mesh with curricula. They allow you to spend time abroad, often without impacting your ability to graduate in four years. Different courses are offered in each program location, so it is important to work with your academic advisers in the college to select the international study experience that will best fit your engineering discipline and your academic goals. You also need to remember that some programs require students to be fluent in a language other than English.

Semester-long study-abroad programs available for you as an engineering student include Perth, Australia; Santiago, Chile; Cairo, Egypt; London, England; Dublin, Ireland; Rome, Italy; and Puebla, Mexico.

Many students prefer summer study-abroad programs. Six-week summer programs are available in Beijing, China; London, England; Dublin, Ireland; Rome, Italy; and Alcoy, Spain.

Engineering students may also choose to study in Dublin, Ireland, for an entire academic year.

Again, be sure to contact your academic adviser to help choose an international study location that fits your needs.
It’s Not All Academics … Even in Engineering

Sure, you’ll be spending a good deal of time in class and laboratory sessions, but there is life outside the classroom. That’s why the College of Engineering offers programs specifically designed to meet some of the other needs students have.

Women in Engineering Program
engineering.nd.edu/nd-engwomen

The Women in Engineering Program addresses the unique needs of women students and helps them develop the leadership and academic skills key to success through programs like our nationally recognized award-winning collegiate section of the Society of Women Engineers and more.

Minority Engineering Program
nd.edu/~mepnd

Diversity is key to a vibrant engineering community and to finding the solutions society needs. Our Minority Engineering Program builds strong leadership skills while it encourages students to participate in campus groups, such as the Notre Dame sections of the National Society of Black Engineers and the Society of Hispanic Engineers and Scientists.

Engineering Leadership Council
elc.nd.edu

The Engineering Leadership Council is the umbrella group for all of the engineering professional and honor societies at Notre Dame. It represents the engineering student body and sponsors academic and career events, such as Engineer’s Week and Industry Day, community outreach programs, and social events.

Engineering Student Organizations
engineering.nd.edu/academics/student-organizations

Student organizations are active across campus, within the community, and within the College of Engineering. From honor societies to student chapters of professional societies, entrepreneurship organizations, and their related clubs, engineering students can find extracurricular groups that fit their interest and abilities.

Local Engineering Service Opportunities

The College of Engineering offers a number of opportunities for students to gain valuable life experience as engineers while also living their faith through service. From Habitat to Humanity to Reins of Life, annual blood drives, tutoring/mentoring programs, and community food drives, there are a variety of ways to serve.

International Engineering Service Opportunities
ndseed.nd.edu
engineering2empower.nd.edu

In addition to local service opportunities, Notre Dame engineers use what they are learning in the classroom to help people and communities around the world through campus organizations like Notre Dame Students Empowering through Engineering Development and Engineering2Empower. There are also many service opportunities with Bridges to Prosperity, Engineers without Borders, Engineers for a Sustainable World, and Engineering World Health.
Straying from the Straight and Narrow
Perseverance pays off.

Originally from Spanish Town, Jamaica, Jean Pierre Clarke came to the United States when he was 12. He enjoyed building model airplanes with his uncle and working on items designed to enhance people's lives. Clarke lived in Harlem for a couple of years after moving to the U.S. but went to Connecticut for high school, where he participated in a program for gifted young men of color called “A Better Chance.”

“I began my time at Notre Dame as a mechanical engineering major, but I switched to aerospace engineering,” he says. It hasn't been an easy or a straight path, but that doesn’t bother Clarke. “I try to not get narrow minded in life by working out defined pathways to my long-term goals because things never work out how you plan them. Instead I embrace opportunities and work with the resources I have to the best of my ability.”

He credits Notre Dame for this perseverance. “Engineering is not easy, but my time here has taught me that no obstacle is too big to handle if you apply yourself,” he says. And the opportunities just keep coming. Most recently, he spent the summer conducting research in electrochemistry and plasma, working to understand the reactive pathways and transport mechanisms of free radicals from plasma to liquid, which is helpful for treating cancer and synthesizing various chemicals. Clarke is one of the authors of a journal paper discussing his team’s findings that will soon be published.

He has also embraced social opportunities. Clarke is a member of the National Society of Black Engineers and the student group Wabruda. He says both are great groups that uplift and support students of color while also offering new ways to get involved in the on-campus and local communities. But Wabruda, which takes its name from the Swahili word for “brotherhood,” holds a special place in his heart. “We meet every Sunday and discuss current topics, from the struggles of a college student to world events,” he says. “More often than not we do not agree, but we still manage to love each other. I know that my brothers will be there to congratulate me when I get my first job, fly with me when I finally get my pilot’s license, and encourage me when I face my next obstacle.”
Every undergraduate degree in the College of Engineering challenges you to think like an engineer, working individually and in teams, just like you will be expected to do after you graduate. There are also plenty of opportunities for hands-on undergraduate research in each department on a variety of projects.
A double major in mechanical engineering and math, Katherine Shih came to Notre Dame knowing she liked to create things and work with her hands. She also enjoyed math and physics, so mechanical engineering seemed like a great fit. And it has been. But it has not been easy. Shih says, “People talk about how hard engineering is, and it is not a cakewalk. But it’s worth it, especially if you go out of your way to find new friends and new experiences.”

She stresses how important it is to seek things off a more obvious path and push past your comfort zone for both academic and non-academic interests. In addition to being a member of the Notre Dame Marching Band, which she says provides a great social group as well as a “mental break” from engineering, Shih spent a semester living in Budapest and working in the RobotLab at Pázmány Péter Catholic University. While there she worked with graduate students and other researchers to teach computers to recognize handwritten signatures and distinguish them from forgeries using touch sensors. “This is just one avenue of the research being done with sensors, and like others it has potential in biometric authentication. While it is relatively easy to forge someone’s signature visually, it is much more difficult to emulate the speed, force, and other dynamics of writing. That’s what the touch sensors help us capture.”

Shih’s lab family was important, but it’s her Notre Dame family she will take with her. “I have friends at other colleges, seniors like me, who feel like they’re caught in a rat race or in a competition with classmates.” According to Shih, whatever a person is going through, Notre Dame students lift one another up instead of bringing each other down. “You’re not alone. There’s a focus on the whole person instead of a single dimension, and it makes a difference.”
The Department of Aerospace and Mechanical Engineering offers two majors. If you are interested in the design, manufacturing, and operation of aircraft or space vehicles, the aerospace engineering major may be for you. It emphasizes basic disciplines — aerodynamics, fluid mechanics, propulsion, orbital mechanics, and solid and structural mechanics — while integrating broader disciplines, such as design, experimental methods, and systems analysis.

During your first years as an aero major you learn the fundamentals. In your junior and senior years, you choose a technical specialization in areas such as design and manufacturing, thermal and fluid sciences, bioengineering, solid mechanics, materials, control and mechanical systems, or computational engineering. Seniors must also complete a senior design project focusing on the overall performance of an aerospace system.

Aerospace graduates leave Notre Dame familiar with multiple fields and types of professional practices. They understand the work aerospace engineers perform and the kinds of problems they solve, and they are well prepared to compete for jobs.

Students entering mechanical engineering also follow a well-rounded program. Their curriculum emphasizes modeling or simulating discrete and continuous mechanical systems; understanding common sensor types; acquiring digital data from a range of transducers; problem-solving using a mix of analytical, numerical and experimental results; programming in several computer languages; and strengthening oral and written communication skills.

In your junior year, you may choose from a variety of technical electives to enhance your degree. These courses cover design and manufacturing, thermal and fluid sciences, bioengineering, solid mechanics, materials, control and mechanical systems, and computational engineering. Your senior design project, which will likely be enhanced by embedded sensors or computers, must focus on the design and development of a mechanical system or product.

Our mechanical engineering graduates leave Notre Dame understanding the work mechanical engineers perform, especially with regard to mechanical systems and designs enabled by embedded computing.
Chemical and Biomolecular Engineering
cbe.nd.edu

The goal of the Department of Chemical and Biomolecular Engineering is to provide an educational program that combines a fundamental focus in chemical engineering with a broader perspective brought in by courses in the humanities and the sciences. Vital technological aspects of chemical engineering are stressed, as well as the complex scientific, social, and moral issues that affect the practice of chemical engineering.

Emphasizing these essential elements better prepares students for careers in chemical engineering in areas such as consumer products, energy, food processing, computer chip manufacturing, pharmaceuticals, medical devices, consulting, environmental remediation, and the sustainability of energy sources and other raw materials necessary for life today.

Chemical engineering undergraduates at all levels have the opportunity to work side-by-side with faculty and graduate students, conducting in-depth research in areas such as polymers, biomaterials, microfluidic devices, catalysis, fuel cells, batteries, and drug-delivery systems.

As a junior or senior, you may choose elective courses that provide specialized training in materials, energy, or biomolecular engineering. The department also offers a pre-med track for those planning to attend medical school.

All students in the department graduate with a strong foundation in chemistry, mathematics, and the applied sciences. They are well prepared for professional careers in chemical engineering, but they are equally prepared to enter graduate school or to pursue careers that may include law, medicine, or business.

Facilities Include
- Catalysis and Reactor Engineering Laboratory
- Computational Molecular Science and Engineering Laboratory
- Corrosion Electrochemistry Laboratory
- Interfacial Soft Materials Laboratory
- Nanoscale Bioengineering Laboratory
- Thermo-mechanical Processing Laboratory
- Tissue Culture Laboratory

Centers and Institutes
- Advanced Diagnostics & Therapeutics
- Center for Microfluidics and Medical Diagnostics
- Center for Sustainable Energy at Notre Dame (ND Energy)

Research Areas
- Bioengineering
- Computational and Molecular Theory
- Hard Materials and Catalysis
- Microfluidics and Diagnostics
- Renewable Energy
- Soft Matter and Nanostructures

Concentrations
Students in the Department of Chemical and Biomolecular Engineering can choose from three concentrations that provide them with suggested elective sequences to get a deeper background in the areas of:
- Biomolecular Engineering
- Energy
- Materials
No Experience? No Problem. Hands-on research gives you experience and confidence.

When Theodore Dilenschneider came to Notre Dame, he knew he loved three things — chemistry, math, and problem solving. He also knew he’d need some practical experience and help applying his talents and love for those things to a career. Chemical engineering felt like a natural path.

Looking back, Dilenschneider says engineering was the right choice. “It [engineering] is difficult, but it teaches you that failure is okay. It’s definitely something that I [and most of my classmates] had not really experienced before beginning the chemical engineering program. Learning how to problem solve from a failure is the most important skill I have learned.”

Dilenschneider has been working in the Water purification and Advanced Transport Engineering Research lab (W.A.T.E.R.) since his sophomore year. “I was nervous at my lack of lab experience and knowledge at first, but everyone — from the lab director to the graduate students also working in the lab — was accommodating and very helpful while I learned,” he says. His time in the lab has given him practical problem solving skills and confidence for tackling any difficult problem.

His research in the W.A.T.E.R. lab and classwork over the last four years have also taught him the importance of improving the viability of current energy resources and discovering new ways of harvesting energy. That’s why he’s planning to pursue a Ph.D. in chemical engineering after graduation. “I want to improve my theoretical background and practical experience in solving problems, eventually shifting from academia to the energy industry where I can apply the skills I’m developing to help solve what I believe to be the largest problem the world will face in my lifetime.”
The Flip Side of Engineering
Working with neighbors.

A major tributary to the St. Joseph River in South Bend, Indiana, Bowman Creek flows above and below ground through the city, particularly the Southeast Neighborhood. Challenges surrounding what should be a picturesque part of the area include combined sewer overflows, E. Coli contamination, and other pollution, all of which interrupt the flow of the creek and pose a risk to residents. For the last two years Notre Dame students have been working with city officials, the Bowman Creek neighborhood, and other local students to find solutions.

This past summer Alicia Czarnecki, an environmental engineering major, served as the Bowman Creek project team leader. She and 22 other interns from six local schools worked on nine different projects focused on implementing smart green infrastructure and community development programs. The projects included designing and building “smart” rain gardens to capture and filter storm water (up to 1,000 gallons of water for every two inches of rainfall) and installing a moisture sensor system to track how the green infrastructure behaves, creating a vacant lot optimization tool to inform city officials and neighborhood organizations on the best reuse of vacant lots, and working with local high schools to incorporate environmental monitoring using Arduino technology.

Projects like these, she says, have to do with collaboration, cooperation, and contributing to the common good ... very much like the Notre Dame mission. “The diversity of our team — working with the city, high schools, other universities, and local business partners — emphasizes that there is a community outside the ‘bubble’ of college. It is very rewarding to come together and do meaningful work that produces tangible results.”
Civil and environmental engineers and earth scientists impact lives on a daily basis as they work to develop sustainable solutions to infrastructure and the environment. They help answer the “big questions” society faces. With above average job growth, these professionals can be found in the public sector from the local to national levels of government as well as a variety of industries in the private sector. For more information on career paths and answering the “big questions,” visit ceees.nd.edu/bigquestions.

As with the other degrees in the College of Engineering, a strong foundation is laid during the first two years. But you still have options regarding your degree. If you are interested in math and physics-based concepts, you should consider our civil engineering program.

The concepts you will pursue through this program are applied to improve and design the natural and built environment. Civil engineering graduates impact society’s well-being and ability to thrive through work on infrastructure, water distribution and treatment, protection from natural hazards, and safe and sustainable environments. Civil engineering students can refine their focus through a concentration in structures or hydraulics at the beginning of their senior year.

Students who enjoy chemistry, biology, earth sciences, and solving problems important to water, air, and soil should consider the environmental engineering or environmental earth sciences majors. The environmental engineering program trains students to understand the necessary chemistry, microbiology, and fluid flow for predicting the fate and transport of contaminants as well as developing treatment and remediation strategies. The earth sciences program provides a foundation in the physical sciences, with emphasis on processes that occur near or at the surface of the Earth and the impact of human activity on such processes.

Throughout each program you will develop knowledge, skills, vision, and an ethical decision-making framework that positions you to become a leader in your industry. The combination of classroom, laboratory, seminars, and field trips exposes you to the realities and professionals in the field so that you can better serve society.
Focusing on the application of computers to real problems, especially with regard to the design, development, and use of software, the computer science program builds upon a foundation of basic science, mathematics, and engineering courses. Students study current computer software and hardware technology while they learn about the key properties of algorithms, and how to design and implement algorithms to efficiently solve programs. Students also explore the theoretical foundations of computer engineering, software and hardware systems, computer applications, and the social and ethical implications of computing technology.

Using modern software development tools and techniques, computer science students develop the ability to engineer large, efficient, portable, and scalable pieces of software that implement algorithms in ways that are helpful to end users. They learn to function independently and on multidisciplinary teams and are well prepared for continued change in computing technology, including understanding its effects on society.

The computer engineering program focuses on understanding the electronic devices that go into the creation of modern computers, as well as the architecture and organization of such systems, addressing issues within central processing units and in larger computer systems. The curriculum builds on fundamental science, mathematics, and engineering courses, while developing a mastery of the principles underlying the organization, operation, and application of modern computers to real problems. As in the computer science program, undergraduates explore the theoretical foundations of computer engineering, software and hardware systems, computer applications, and the social and ethical implications of computing technology. The computer engineering program also provides students with significant design experience.

Computer engineering students learn to use modern design tools and techniques to develop, analyze, and prototype digital computing systems. The senior design experience gives students the opportunity to analyze a problem, identify a potential solution, place the solution in the context of existing work, implement a prototype of the solution, test and assess the prototype, and document and present the work.
Going the Distance
A passion for technology and the betterment of society.

Hawaii native Matthew Perez didn’t visit any of the universities to which he was admitted. “I did talk to some Notre Dame alum at home and realized that coming here would not be a typical college experience. It’s more a family-like bond that will last a lifetime,” he says.

Perez began his engineering career as an electrical engineer. But after taking some introductory courses, he found he enjoyed coding and the skills it developed. That’s also when he became interested in undergraduate research. Notre Dame’s Balfour-Hesburgh Scholarship Program for underrepresented minorities and first-generation college students was a big help in that it provided resources, opportunities, and guidance in his search for research and graduate related projects in which to participate.

His first year Perez worked in a biomedical photonics research group studying imaging and diagnostics. Following that he worked on mobile health apps and programming tools for speech analysis. He has also worked in the Notre Dame Mobile Computing Lab building an iOS app designed to collect the speech data of children diagnosed with autism. And he has studied how speech biomarkers can be used to diagnose concussions. In fact, he and his team published the results of that research in the Journal of Biomedical and Health Informatics.

Most recently, Perez interned at Garmin Inc., working with the iOS team developing new features for a mobile app that connects to wearable health devices and tracks heart rate, number of steps, sleep, and other activities. These are just a few of the projects in which he has been involved. It’s no wonder he’s planning to pursue a graduate degree in machine learning and its application for improving healthcare.
What Did You Do Last Summer?
Research fellowship program in nanoengineering.

During the academic year Nicolas Garcia, a senior majoring in electrical engineering, spends a lot of his extracurricular time with the Notre Dame Glee Club. He also serves as an engineering student mentor to first-year students in the McCourtney Learning Center. Instead of relaxing on a beach this summer, he was hard at work as one of 30 students who participated in the NDnano Undergraduate Research Fellowship Program.

For 8 weeks Garcia worked under Professor Jonathan Chisum on a project entitled “Microfabricated Structures for Millimeter-wave and Sub-millimeter-wave Electronics” that focused on antennae hardware for microwave communications. “I was trying to build a very particular lens for signal broadcasting at high frequencies,” he says. “The lens technology I worked on will hopefully provide an effective means for broadcasting high frequency signals so that we can improve wireless communications.”

According to Garcia, this is important because the electromagnetic communications spectrum is saturated. Corporations and government agencies have taken up most of the bandwidth that current technology can handle. In order to keep up with the demand for wireless devices, new devices must be built that work at extremely high — and currently available — frequencies.

Although he conducted the research in a team atmosphere, Garcia felt as if the project was his own at times. “I was actively controlling the direction of the research, and I was free to pursue any routes I thought were promising,” he says. “It gave me a glimpse of what it takes to direct a project and the future I might experience as a tech entrepreneur. But that’s a ways down the road.”
As a Notre Dame electrical engineering major, you will be immersed in the technology at the heart of the information revolution — enabling everything from cell phones and video games to medical information processing, next-generation integrated circuit (IC) chips, and the Internet of Things. But it all starts with a solid foundation in the analysis and design of electronic circuits, systems, and devices.

Our curriculum includes required and elective courses across a broad range of technologies. During your first two years, you will build a breadth of understanding that lays the groundwork for specialized study. Then, as a junior and senior, you may select from a variety of elective courses focusing on a specific area, such as nanotechnology, wireless communication systems, microelectronics and IC fabrication, signal and image processing, photonics, control systems, or “green” energy technologies like photovoltaics and hybrid electric vehicles.

As you begin looking for full-time job opportunities in your senior year, you’ll find the options are unlimited. Every industry that requires “high tech” information processing needs electrical engineers. Our students have gone on to take important roles in national security, entertainment, telecommunications, finance, aerospace, power generation, chemical processing, and construction.

If additional study is in your future, you should know that many of our undergraduates go on to study at the world’s finest graduate schools, including Princeton, MIT, University of California at Berkeley, Illinois, Texas, and Cornell University.

Research Areas
- Control of Intelligent and Embedded Systems
- Digital and Wireless Communications
- Digital Signal and Image Processing
- Distributed Sensor Networks
- Microelectronic Materials and Devices
- Nanostructure Devices, Modeling, Simulation, and Fabrication
- Optoelectronics

Concentrations
Students in the Department of Electrical Engineering are able to focus their efforts through the careful selection of electives leading to degree concentrations that are recognized on their undergraduate records. Concentrations are available in five areas:
- Biosystems
- Communications
- Energy
- Multimedia
- Semiconductors and Nanotechnology

Facilities Include
- Communication Systems Research Laboratory
- Device Simulation Laboratory
- Distributed Systems Laboratories
- High-speed Circuits and Devices Laboratory
- Laboratory for Image and Signal Analysis
- Magnetic Devices Laboratory
- Nanoelectronics Laboratory
- Nanofabrication Facility
- Nano-optics Laboratory
- Optoelectronics Laboratory
Industry Day: Preparing for a Career

Every year the College of Engineering, in conjunction with the Engineering Leadership Council and the Society of Women Engineers, sponsors a career fair for students. The fair and related activities provide the opportunity for students and companies to interact with one another on professional and social levels for internships and full-time employment.

In preparation for Industry Day activities, the college and Career Center work with students to develop resumes and hone interviewing skills.

This past year more than 80 companies attended Industry Day to meet and hire Notre Dame engineering students. They included:

- Accenture
- Analog Devices, Inc.
- Biomet, Inc.
- Boeing
- Booz Allen Hamilton
- BP Energy Company
- Bristol-Myers Squibb
- Central Intelligence Agency
- Daimler Chrysler
- Delphi Automotive Systems
- Department of Defense
- DuPont
- Federal Bureau of Investigation
- Ford Motor Company
- General Electric
- Hewlett-Packard
- Honeywell
- Ingersoll-Rand
- Johnson and Johnson
- Kiewit Corporation
- Lockheed Martin Corporation
- Marathon Ashland Petroleum LLC
- Microsoft Corporation
- Northrop Grumman
- PPG Industries
- Raytheon
- Textron Industries
- Turner Construction
- Unisys Corporation
- Westinghouse Electric Company
- Xerox
After Graduation

The College of Engineering is here to help you succeed, not only as a student but also as a professional engineer. We stay in close contact with our alumni, as well as with corporations and research facilities across the country, so that we can offer you the best opportunities for undergraduate research experiences and student internships. We also work with the University’s Career Center to help you locate, prepare for, and interview for positions in industry, government, and graduate schools as you get closer to graduation.

We know that Notre Dame engineers are technically excellent. Approximately 99 percent of our seniors pass the Fundamentals of Engineering exam, compared to 77 percent nationally. But companies today want even more. They want the whole package. We’re proud to say that company representatives often comment on the outstanding communication skills and team attitude displayed by our graduates. They tell us those “soft” skills are two of the many reasons they hire Notre Dame engineers; they know they are getting well-rounded professionals.

75 percent of our students choose full-time employment upon graduation
17 percent attend graduate or professional school
5 percent pursue careers in the military
3 percent join service and other programs

Want to know more?

**No problem.**

Check out our Web site for more student stories and details on the degrees and opportunities you’ll find through Notre Dame Engineering.

[engineering.nd.edu](http://engineering.nd.edu)