Engineering at Notre Dame
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. 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.)
- Ninety-nine percent of our courses are taught by faculty.
- 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.
- More than 95% of our engineering graduates complete their degree requirements in four years.
- 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.
- 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 Introduction to Engineering (EG 10111/10112) 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.

The courses are taught in sections of 40-45 students, so that all students benefit from the attention of course instructors.

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>
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<td>General Chemistry — Fundamental Principles</td>
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<td>Introduction to Engineering Systems I</td>
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<td>Moreau First Year Experience</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.
Grand Challenges Scholars Program at Notre Dame

The College of Engineering is one of 40 engineering schools around the world to participate in the National Academy of Engineering’s Grand Challenges Scholars Program (GCSP), a selective program where students focus on game-changing goals for improving life around the world by addressing the grand challenges they will face as engineers in the 21st century.

The four themes on which the program focuses are sustainability, health, security, and the joy of living. Students are required to engage in transformational learning and research activities and are held to the highest levels of scholarship and service as a reflection of their responsibilities as engineers and the Notre Dame Mission.

Examples of projects of current ND-GCSP students include engineering better medicines for selective drug delivery and imaging, developing graphene-based iron carbide for fuel cell applications, reverse-engineering the brain, studying more efficient methods of carbon sequestration for cleaner air, and addressing issues of access to clean water in developing countries.

Even though the Notre Dame GCSP is open to all engineering undergraduates in good academic standing (≥2.0 GPA), each student must apply, ideally within the first two years of study. Information on the application process, program requirements, and the five dimensions of the Notre Dame GCSP — research experience, interdisciplinary curriculum, business/entrepreneurship, multicultural/global experience, and social consciousness/community engagement — can be found at engineering.nd.edu/gcsp

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.
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.

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.
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 five courses past degree requirements and include: bioengineering, computational engineering, energy engineering, energy studies, engineering corporate practice, 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 interrelationships 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.
Lifetim e Learner
Learning something new and sharing those experiences with others is what it’s all about.

Cristina Chavez has known she wanted to be an engineer since fifth grade when her final science project was to work as part of a group creating and programming a LEGO robot to compete against other robots on an obstacle course. “I loved every second of that project and joined a robotics club the following year,” she says. In high school Chavez continued to follow her love of robotics, learning more about power tools and 3D printers to give her team a competitive edge.

Today, this junior mechanical engineering major [and science, technology, and society minor] is still working with power tools and 3D printers. She’s a teaching assistant (TA) in the Aerospace and Mechanical Engineering Student Fabrication Lab/Makerspace located in Stinson-Remick Hall of Engineering. As a TA, she trains other students on the equipment and helps them if they have difficulties.

Chavez, who is also a member of the Notre Dame chapter of the Society of Women Engineers, encourages young girls to study science, technology, engineering, and mathematics through activities such as the chapter’s annual Girl Scout Day. She and other mentors lead the scouts through a series of engineering based activities and share their experiences with the girls, including what classes to take.

“Take more than just engineering courses. General requirement courses,” she says, “force you to think in a different frame of mind, to tackle problems from a new perspective, and to learn how to convey your ideas in a way that makes sense. This makes you a more well-rounded person who is able to complete difficult engineering tasks but also able to explain your thoughts to those without a technical degree, connecting to engineers and non-engineers alike.”
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 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.
Active Researcher
On-campus research opportunities and summer internships provide real-world experience.

Most people would assume that an undergraduate pursuing a double major in electrical engineering and computer science would have no time for research or club activities. They would be wrong. Zachary Kowalczyk, a junior from Wheaton, Illinois, has done all of that. For example, his most recent campus research experience was working with an electrical engineering faculty member to implement a system that created a 360-degree bird’s-eye-view of the area surrounding a remote-controlled car. He’s actively looking for another research team for the new year.

Kowalczyk also worked as a summer intern in the Satellite Development Center at Boeing Space, Defense, and Security performing worst-case circuit analysis and lab testing on satellite electronics prototypes and has been invited to return next summer.

In addition to being an active researcher, he has participated in hackathons through the Entrepreneurship Club and competed in the Shurz Innovation Challenge, a yearly entrepreneurship competition held at Innovation Park. He is also an active member of the Notre Dame Running Club and the Robotic Football Club. “The Robotic Football Club is the activity that has most impacted me during my time at Notre Dame,” he says, citing its cross-disciplinary nature and the hands-on experience team members gain, which potential employers find impressive.

He believes his success as a student can be traced back to his professors who have taken a personal interest in his education. Kowalczyk has found this true both in the classroom setting, where they have been very involved, as well as outside the classroom, where they assisted with his overall goals and career development. “I truly believe Notre Dame engineering is unique in its approach, taking an interest in each student to ensure that student achieves his or her personal goals.”
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.
Team Player
Collaborating and communicating as part of a community makes a difference.

Engineers often talk about the impact they want to make. But how does one measure that impact, whether a career — as a student or a professional — is a successful one? According to Holly Miller, a junior from Canton, Ohio, majoring in chemical engineering, it's community and the way members of the community learn and grow together.

From her research experiences studying the synthesis and characterization of uranium crystals and also investigating the usefulness of various catalysts for applications in biomass conversions, to her semester spent studying in Dublin, Miller has experienced communities of all kinds. She’s learned how to work independently and as a member of a team.

She has participated in service activities through the Notre Dame Chapter of the Society of Women Engineers, collaborated with the City of South Bend on local projects, and worked with young boys and girls on STEM activities. Miller has also interacted with members of her dorm community, as well as the alumni on her department’s advisory council. She’s quick to share the impact these experiences made on her because they manifested so plainly the interconnectedness of the Notre Dame community and its passion for making an engineering education here the best it can be.

“If a student asked me about the engineering program at Notre Dame,” she says, “I would tell them the professors are experts in their fields and extremely accessible to students who seek help with classwork or even just someone to talk to. But what has really made Notre Dame engineering special for me is the camaraderie and support that I find among my classmates. I feel so lucky to be able to learn in an environment that encourages collaboration rather than competition.”
Dreamer and Doer
Engineering to make a difference means getting your hands dirty and experiencing life.

A degree in engineering was appealing to Patty Dirlam for a number of reasons. First, she's very good at math and science (except for chemistry). Secondly, she's interested in city planning, specifically transportation and traffic flow. Most important, however, is that engineering allows her to use her unique skill set to make a difference in the world.

Dirlam, a sophomore majoring in civil engineering, believes participation is the key to being able to make the biggest difference, which is why she has been involved in a variety of activities from her hometown in Gaithersburg, Maryland, to the Notre Dame campus and South Bend community, to her recent summer in Rome. “It is a special thing to be able to sit at such iconic places as the Pantheon and Colosseum and feel like you are sitting in your backyard while tourists buzz around you ... or to play soccer by ancient aqueducts,” she says. “Being part of the study abroad program helped me find a new sense of independence and willingness to explore, to leave my comfort zone ... as well as teach me the fundamentals of engineering ethics and businesses practices, of course.”

Rome is only one of the “unforgettable experiences” Dirlam has had as an engineering undergraduate. She has conducted research focused on advanced stress testing of 3D modeled structures in one of her department’s labs. She’s interning for a Maryland based start-up that produces algae with advanced bioreactors and is actively applying for grants, including one through her department to study earthquake vulnerability of old Catholic churches in Italy over the summer. She is also involved in the Notre Dame Climbing Club and minoring in 3D Studio Art (Ceramics).
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; Berlin, Germany; Rome, Italy; Auckland, New Zealand; 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.

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<thead>
<tr>
<th>Engineering Leadership Council</th>
<th>Minority Engineering Program</th>
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<td>eic.nd.edu</td>
<td>nd.edu/~mepnd</td>
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<tr>
<td>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.</td>
<td>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.</td>
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<td>engineering.nd.edu/nd-engwomen</td>
<td>engineering.nd.edu/resources/engopps</td>
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<td>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.</td>
<td>In addition to local service opportunities, such as Habitat to Humanity and tutoring/mentoring programs, Notre Dame engineering undergraduates use what they are learning in their classrooms and labs to help people around the world through organizations like Engineering 2Empower, Notre Dame Students Empowering through Engineering Development, and Engineers for a Sustainable World.</td>
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<th>Honor and Professional Societies</th>
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<td>engineering.nd.edu/academics/student-organizations</td>
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<td>Student organizations are active across campus, within the community, and within the College of Engineering. From honor societies to student chapters of professional societies, engineering students can find extracurricular groups that fit their interest and abilities.</td>
<td>Interested in building and racing concrete canoes, how about designing a robotic football team, or flying your own radio-controlled airplane? Notre Dame engineering students have a wide range of extracurricular activities available to them. Some of these are linked to professional engineering societies. All of the clubs and competitions offer unique hands-on experiences and tons of fun with fellow students.</td>
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Difference Maker
A passion for technology and a heart for people are great steps toward success as an engineer.

One stereotype of an engineer is an individual so caught up in technology that he or she has neither the time nor the skills to interact with others on a personal basis. Like many other Notre Dame engineering undergraduates, David “Seun” Odun-Ayo disproves that notion on a daily basis.

A junior from Lagos, Nigeria, he is pursuing a degree in computer science with the hope of working at a software engineering company after graduation. Odun-Ayo chose computer science as his major because of his love for technology but also because of his dedication to using his talents to improve the lives of those with disabilities. “We all need a little help now and then,” he says. “We don’t go through life alone. The real world doesn’t work like that and neither does Notre Dame engineering.”

He’s quick to point out that many groups on campus have encouraged him become more confident as an engineer and as a person, groups such as the Minority Engineering Program, the Notre Dame chapter of the National Society of Black Engineers, the Black Student Association, and WaBruda student group. “Being part of these groups has helped me build relationships that will last throughout my life, as well as hone some of the skills necessary to be successful once I leave Notre Dame,” he says.

The campus community has played a key role in Odun-Ayo’s educational experience. But he has also developed friendships with those he serves, and those he serves alongside, in community service activities with the local Boys and Girls Club and South Bend Code School. His favorite advice for other students is, “Don’t try to do it alone!” and “Make sure to go to office hours.”
FIVE Departments.
NINE Degrees.
ENDLESS Possibilities.

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.
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. Junior and senior years focus on more advanced topics, such as flight mechanics, control and design, propulsion, aerodynamic experimentation and others.

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.
Path Finder
Learning lessons along the way is the best way to reach a goal and measure success.

The road to Notre Dame was the last one that Katherine Cameron intended to travel. She was tired of following in the footsteps of her oldest sister and wanted to make a name for herself, so she explored several universities. “I’d be set on attending a certain school until I would stay overnight. Then I’d usually find the academics were cutthroat, classmates were ruthless, and sports meant nothing,” she says. “I wanted a school that felt more like a family, offered academic rigor, and had great athletic programs.” Notre Dame checked all of those boxes for her.

A Jacksonville, Fla., native and part of the Naval Reserve Officers Training Corps (ROTC) at Notre Dame, Cameron is studying aerospace engineering. As a Midshipman, she has learned to strike a balance between the military discipline of the ROTC program and life as a college student. While she is training to become a Naval Officer through physical drills, leadership labs, and ROTC specific courses, she is knee deep in engineering concepts. “I’ve found the courses interesting and applicable to the real world,” she says. “Classes are not always easy, but they are rewarding.”

She has also found that learning the material is much more important than a perfect grade, a lesson she shares with local elementary students. Cameron volunteers weekly as part her dorm’s tutoring program through a local parish, helping elementary school students with their studies.

In addition, she’s heavily involved in Notre Dame’s intramural and CoRec sports programs, participating in flag football, dodgeball, sand volleyball, basketball, ping pong, broomball, soccer, wiffle ball, and club swimming.

Cameron’s made her experience at Notre Dame her own and will report for active duty in the United States Navy upon graduation, where she hopes to attend flight school and become a Naval Aviator.
Care Giver
Finding the connection between career and community requires making the most of a variety of opportunities.

Like many of his classmates, César Martín Moreno exhibits a passion for learning, growing, and giving back. It’s what drove this Balfour-Hesburgh Scholar and Montebello, California, native to pursue a dual major — chemical engineering and neuroscience and behavior — with a bioengineering minor and pre-med concentration. That means he’s spending five years at Notre Dame completing his degrees.

“I’ve always been interested in medical research. When I came to campus, Notre Dame’s Building Bridges Program connected me with a faculty member who introduced me to biomedical engineering as a profession,” he says. “The neuroscience part of my program is also important because I want to conduct research in neurodegenerative diseases, such as Alzheimer's, which runs in my family.”

Moreno has filled each semester with a variety of research projects — from generating nanofiltration membranes to exploring the special properties of rhodopsin genes in mosquitoes and flies. He’s studied abroad in the New Zealand program with the Department of Civil & Environmental Engineering & Earth Sciences and the Summer in London program with the Department of Chemical and Biomolecular Engineering. He’s volunteered for the National Immigration Justice Center and organized service projects at the local Ronald McDonald House and Unity Gardens. He is also a member of the Latinx Honors Society and the Society for the Advancement of Chicanos/Hispanics and Native Americans in Science.

“I knew Notre Dame would be a place where I could explore my interests and the world,” says Moreno. “The University met my financial needs and provided academic resources and support when I needed it.” Upon graduation, he plans on joining the Alliance for Catholic Education program to teach science for two years like several of his teachers did. Then it’s off to medical school.
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.
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. 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.

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.
Everyday moments and close friendships amplify quality of life.

Christian Dennis chose to study engineering because he is very good at math and science. However, he picked civil engineering — with a concentration in structural engineering — as his major because it was the degree with which he felt he could do the most good. The infrastructure required to design and build cities and roadways is similar to the groundwork he lays every time he volunteers at local organizations, participates in Campus Ministry, or spends time with his classmates.

It is both the time he invests and the work he is doing that is making a difference in people’s lives. In fact, between serving at Holy Cross retirement home, the local homeless shelter, and the South Bend Historical Society — not to mention planting local rain gardens, participating in community clean-ups, and fighting as a Bengal Bouts boxer, it’s hard to imagine that Dennis has had any time to study or develop close-knit friendships with his classmates and those he serves.

Still he accomplished all that and more, including singing in the Liturgical Choir and playing several intramural sports. He also works with Right to Life on end-of-life issues. He has even spent a summer abroad, studying engineering in Dublin. But his best memories have been praying at the Grotto with friends and singing the Alma Mater ... anywhere, any time. “For me, those moments epitomize what the Notre Dame family is,” he says.

Dennis plans to spend the summer immediately after he graduates building a bridge in Latin America with ND-SEED and then hopes to join a national engineering firm as a structural engineer.
Problem Solver
Pairing an engineering major with a corporate practice minor was a logical choice.

Seth Cattanach began his first year at Notre Dame with the intention of becoming a chemical engineer. The junior from Lake Elmo, Minnesota, is now a computer engineering major working toward a minor in engineering corporate practice. “That’s one of the great things about Notre Dame — you don’t need to know what you want to do when you start the engineering program. As a first-year student you have options you don’t even know about yet ... from technical consulting to med school to patent law, academia, even the military. The thing is you’re choosing a great program with tons of opportunities.”

Cattanach is interested in working with big data and machine learning once he graduates, whether that’s as a data scientist or a technical consultant. His minor has taught him that engineering and business are a natural fit. “Business problems aren’t really that much different than engineering problems,” he says. “You still have to analyze a situation and come up with a solution. What’s more, many business problems require very technical solutions.” He believes that the Integrated Engineering and Business Practice sequence, the basis of his minor, has given him a solid introduction to solving real-world business problems while also helping him develop skills that will help him succeed in any field.

While Cattanach has been solving technical problems in his courses, he has also been taking advantage of many other opportunities as an engineering undergraduate. He is co-president of the Nordic Ski Club at the University. He volunteers with College Mentors for Kids, a nonprofit organization that connects college mentors with at-risk youth. And he’s headed to London, England, as part of the Notre Dame International program, to spend a semester studying there.
Computer Science and Engineering
cse.nd.edu

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.
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 Cornell University, ETH Zurich, Illinois, Imperial College London, MIT, Princeton, Texas, and University of California at Berkeley.
Power Connector
Tapping to community and hands-on experiences helps find real-life solutions.

Joining the Band of the Fighting Irish, and participating in marching band, concert band, pep band, and small wind ensembles, was like coming home to family for Annalise Arroyo. A junior from Fox Island, Washington, Arroyo says, “The band was my entrance into the Notre Dame community, but there are an infinite number of ways to be part of the campus community, whether it be through your dorm, intramural sports, or any number of clubs or activities.”

Arroyo, who is pursuing a degree in electrical engineering with a concentration in multimedia, has taken advantage of several opportunities to connect while here at Notre Dame. For example, she is an officer for the Robotic Football Club and has conducted research for the club to design a new LED system for their robots [players]. She has also taken a research class for the club in order to redesign the standard base for their robots, which helped improve their connectivity and power usage.

This past summer she interned off campus at a naval research facility. Part of the Naval Research Enterprise Internship Program, Arroyo worked at the Naval Undersea Warfare Center in Keyport, Washington, designing and prototyping a power management board. She also worked with microcontrollers and wrote a sensor interfacing code in Python.

According to Arroyo, her summer experience confirmed her decision to pursue electrical engineering. “I chose engineering because I’m passionate about designing and building things and them watching them work,” she says. “I chose electrical engineering because I enjoy working in the space where software and hardware interact.”

Arroyo’s plans for the future include working in control systems or digital signal processing and pursuing a Master’s degree in robotics.
Industry Day: Preparing for a Career

Every year the College of Engineering and the Engineering Leadership Council sponsor 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 90 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.

- 81 percent of our students choose full-time employment upon graduation
- 12 percent attend graduate or professional school
- 3 percent pursue careers in the military
- 3 percent join service and other programs
- 1 percent seeking employment
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