Engineering
(B.S.E. degree)

"Today's engineers need to be equipped to solve problems that do not yet exist. Engineering education provides the technical skills to solve the issues of today, but the liberal arts foundation will enable students to conquer the great challenges of tomorrow."
Brian Johns, assistant professor of engineering sciences

The bachelor of science in engineering (B.S.E.) can lead to a diverse set of possible career paths in engineering. The B.S.E. provides a strong foundation in engineering principles and emphasizes hands-on learning experiences. Students in Cornell's Engineering program:

- Design solutions to engineering challenges, beginning with their first engineering course: Intro to Engineering Design.
- Gain fundamental knowledge of 3D design, model assembly, and engineering drawings that will translate to the engineering industry.
- Learn through hands-on classroom projects integrated into extended class periods.
- Regularly practice writing, teamwork, and presentation skills.
- Study the social, historical, economic, and environmental context in which engineering solutions are developed as part of their liberal arts curriculum.

As in all Cornell courses, engineering students learn in small classes taught by experienced professors whose full-time focus is creating engaging courses for undergraduates. Classes are always small, and students quickly develop supportive relationships with professors and other talented students.

ENGINEERING AND THE LIBERAL ARTS

Engineering is fundamentally about developing solutions to complex challenges in a rapidly changing world. These challenges require more than just knowledge of math, science, and technical skills. They also require the types of collaboration, communication, and broad-minded, problem-solving skills that are best learned in a small, liberal arts setting.

The department believes its approach to engineering education is exactly what was called for in a report by the National Institute of Engineering titled "The Engineer of 2020: Visions of Engineering in the New Century":

> *We aspire to engineers in 2020 who will remain well grounded in the basics of mathematics and science, and who will expand their vision of design through a solid grounding in the humanities, social sciences, and economics. Emphasis on the creative process will allow more effective leadership in the development and application of next-generation technologies to problems of the future.*

Developing broadly trained engineers with competence in the many and varied skills they will need in their careers is the basis for our program and the hallmark of what Cornell has always done best.

BENEFITS OF ONE COURSE AT A TIME

One Course At A Time provides many opportunities for project-based learning. It is easy for professors to devote extended time for projects and labs, and each course enjoys its own dedicated space for 18 days, plus weekends. Engineering projects can be left in that space after class to be worked on outside normal class hours.

A less-obvious benefit of the block plan is that it prevents time-intensive courses from dominating students' schedules, giving them access to the full liberal

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Faculty Bios & Courses

KARA BEAUCHAMP
Professor of Physics and Engineering
Teaches courses in physics, including Astronomy, Modern Physics, and Astrophysics. She currently collaborates with students on astrophysics research projects, and she has also studied high-temperature superconductors, magnetic materials, dye-sensitized solar cells, and local wind energy project feasibility. Ph.D. in physics, University of Minnesota; B.A., Carleton College.

BRIAN D. JOHNS
Assistant Professor of Engineering
Teaches courses covering a range of engineering topics, including design principles, mechanics, thermodynamics, and materials. He also teaches upper-level electives and the engineering capstone course. He is a member of the Institute of Industrial Engineers (IIE) and the American Society of Mechanical Engineers (ASME). Ph.D. in industrial engineering and M.S. in mechanical engineering, University of Iowa.

NILOOFAR KAMRAN
Assistant Professor of Engineering
Teaches introductory physics and engineering courses, as well as upper-level courses in engineering, such as Fluid Dynamics, Heat Transfer, and Signals and Systems. Her research focuses on controlling complex systems, with applications in control of satellites and of fluid flow of fuel in a rocket thruster. Ph.D. in engineering physics, Embry-Riddle Aeronautical University; M.S. in aerospace engineering, Shahid Beheshti University, Iran; B.S. in mechanical engineering, Guilan University, Iran.

DERIN SHERMAN
Professor of Physics and Engineering
Teaches courses in physics and engineering, including Engineering Circuits, Lagrangian Mechanics, upper-level Electricity and Magnetism and the physics capstone Advanced Experimental Physics. He also teaches the nonmajors courses Science through Film and Fiction and Electronics for Everyone. Ph.D. and S.B. in physics, Massachusetts Institute of Technology.

arts experience. While engineering and sciences courses will be demanding, they do not take away time from courses in art, history, psychology, or other subjects students may be interested in exploring.

Another advantage is that professors can offer more time for exams. This allows students to approach exams at a more relaxed pace, while answering questions that test their real understanding, rather than their ability to quickly recall information.

RESEARCH AND INTERNSHIPS

CAPSTONE PROJECTS

As a capstone project to complete the engineering major, students work on a design project in a small group to formulate an engineering solution to a real-world problem. Specific projects are chosen in an area of the student's interest, based on prior consultation with the instructor.

The first engineering capstone course will be offered in Spring 2018. Here are recent examples of engineering-related projects that physics majors designed and completed during their advanced lab capstone course:

- Developed electronics to generate ultrasonic standing waves and used them to levitate small objects.
- Assessed structural resonance and earthquake readiness of a Memphis high-rise, using virtual and physical models.
- Created graphene and used it to make a supercapacitor.
- Created a user interface control system using Doppler Shifted Ultrasound to recognize hand gestures.
- Created a DC-DC converter to create a usable solar power supply.
- Built an exoskeleton arm controlled by an EMG signal.
- Made a high-resolution scanning tunneling microscope.
- Studied solar cells based on quantum dots.
- Built and studied a system to wirelessly transfer electric power using magnetic resonance.

ON-CAMPUS RESEARCH

Physics and engineering students and faculty regularly engage in collaborative summer research projects. These projects allow students to develop important research skills while working both independently and alongside faculty mentors, and they often provide a stepping stone to research opportunities at larger institutions. Current research projects include:

- Creating a virtual-reality (VR) surgical simulator for orthopedic surgeons to alleviate the costs, risks, and errors associated with training surgical residents in real operating rooms.
- Exploring properties of star-forming regions.
- Developing videos showing how to construct useful equipment for both doing physics demonstrations and exploring a range of physical phenomena

AFTER CORNELL

ALUMNI CAREERS

An engineering degree from Cornell positions students well for jobs that require training in electrical engineering or mechanical engineering, as well as related fields such as computer engineering. National Association of Colleges and Employers (NACE) reports average starting salaries in those fields as $60,900, $61,000, and $65,300, respectively. These are some of the fastest growing fields in the U.S., with a diverse range of employment possibilities and high average starting salaries.

The department won't graduate its first class of engineering majors until 2018, but the examples below illustrate the success that recent physics majors have had in pursuing careers in engineering or related fields.

Project administrator, BI Worldwide, Saint Cloud, Minnesota (Class of 2014)

Web development track, Startup Institute, Boston, Massachusetts (Class of 2013)

Electrical engineer, Textron Aviation, Wichita, Kansas (Class of 2012)

Associate technician, NSF International, Ann Arbor, Michigan (Class of 2011)

Advanced support services engineer, LogRhythm, Boulder, Colorado (Class of 2011)

Lead hardware engineer, Corsica Innovations, Boulder, Colorado (Class of 2010)

Research technician, Sundrop Fuels, Longmont, Colorado (Class of 2009)

Research chemist, Inovatia Laboratories, Columbia, Missouri (Class of 2008)

Environmental scientist, Naismith Engineering, Corpus Christi, Texas (Class of 2007)

Safety basis and technical services engineer, URS Corp., Oak Ridge, Tennessee (Class of 2006)

Firmware engineer, HID Global, Eden Prairie, Minnesota (Class of 2006)

GRADUATE SCHOOLS ATTENDED

The department won't graduate its first class of engineering majors until 2018, but the examples below illustrate the success that recent physics majors have had in pursuing graduate degrees in engineering or related fields.

Ph.D., electrical engineering, University of Minnesota, Minneapolis, Minnesota (Class of 2016)

M.S., sustainable engineering, Rochester Institute of Technology, Rochester, New York (Class of 2013)

M.S., electrical and electronics engineering, Wichita State University, Wichita, Kansas (Class of 2012)

Ph.D., computer science, University of Colorado Boulder, Boulder, Colorado (Class of 2012)

Ph.D., computing, University of Utah, Salt Lake City, Utah (Class of 2012)

Ph.D., electrical engineering, University of Minnesota, Minneapolis, Minnesota (Class of 2012)

M.S., electrical and computer engineering, Colorado State University, Fort Collins, Colorado (Class of 2010)

M.S., electrical and computer engineering, Iowa State University, Ames, Iowa (Class of 2010)