Engineering Sciences
(B.A. 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 Engineering Sciences (B.A. degree) is very similar to our Engineering (B.S.E. degree), but it provides more course flexibility because it requires fewer total courses than the Engineering (B.S.E. degree). The flexibility allows students to couple engineering with courses in other areas—anything from art, to politics, to biology. The engineering sciences major provides a strong foundation in engineering principles and emphasizes the best of Cornell College's small school, liberal arts experience.

Students in Cornell's Engineering Sciences 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.

Courses are 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 their 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

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Faculty Bios & Courses

KARA BEAUCHAMP
Professor of Physics and Engineering
Teaches courses in physics, including Astronomy, Introductory Mechanics, 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., physics, University of Minnesota.

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 and Systems Engineers (IISE) and the American Society of Mechanical Engineers (ASME). Ph.D., industrial 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. Ph.D., engineering physics, Embry-Riddle Aeronautical University.

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., physics, Massachusetts Institute of Technology.

plan is that it prevents time-intensive courses from dominating students' schedules, giving them access to the full liberal 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 all courses end by 3 pm. This means that students involved in athletics and music don't have conflicts between practice or rehearsals and their courses. Students at Cornell are often involved in a variety of activities outside the classroom.

RESEARCH AND INTERNSHIPS

CAPSTONE PROJECTS

As a capstone project to complete the 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.

We began offering the engineering capstone course in spring 2018. Here are recent examples of engineering-related projects that engineering and physics majors designed and completed during their capstone course:

- Designed and prototyped a powered lifting chair that aimed to assist people with ambulatory difficulty.
- 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 sciences majors 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 sciences degree from Cornell positions students well for fields such as engineering technician, engineering or technical sales, and technical writer. National Association of Colleges and Employers (NACE) reports median salaries in those fields as $63,660, $98,720, and $70,930, respectively.

The department graduated its first class of engineering majors in 2018. The examples below include positions held by both engineering and physics majors.

Design engineer, TriMark Corporation, New Hampton, Iowa (Class of 2018)

CAD design engineer, Cobham Mission Systems, Davenport, Iowa (Class of 2018)

Civil designer, Shive-Hattery, Cedar Rapids, Iowa (Class of 2016)

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

Project engineer, Furlong Industrial Systems, Milwaukee, Wisconsin (Class of 2013)

Senior software engineer, Cazena, Minneapolis, Minnesota (Class of 2013)

Device and integration development engineer, Intel Corp, Hillsboro, Oregon (Class of 2012)

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

Software engineer, MetricStory, Seattle, Washington (Class of 2012)

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

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

Process engineer, Intel Corp, Hillsboro, Oregon (Class of 2010)

Lead hardware engineer, Leaf, Greeley, Colorado (Class of 2010)

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

GRADUATE SCHOOLS ATTENDED

The department graduated its first class of engineering majors in 2018. The examples below include graduate programs being pursued by physics majors.

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)