

Undergraduate Programs

Mechanical Engineering • Engineering Mechanics





Welcome to MechSE!

As a student in the [Department of Mechanical Science and Engineering \(MechSE\)](#) at the University of Illinois at Urbana-Champaign, you will take

courses from and interact with the world's leading engineers and scientists. At the same time, you will join a close-knit, supportive group and will be well-prepared to embark on a successful career in the specialty of your choosing.

The [MechSE undergraduate programs](#) are consistently among the top-ranked mechanical engineering and engineering mechanics programs in the United States as a result of distinguished faculty, state-of-the-art facilities, excellent undergraduate research opportunities, active student organizations, a collegial and collaborative environment, and exceptional students from around the world.

Our primary goal is to educate our students to become future leaders in engi-

neering, science, technology, and beyond, leading the way toward improving our society's quality of life. From green energy initiatives like hydrogen and solar, to bio-engineering and mechanobiology, MechSE offers students opportunities that are broad and rich.

The MechSE curriculum develops the critical thinking skills necessary to solve the toughest engineering problems that exist now and in the future.

What brings all of these advantages together is the wonderful sense of community within the MechSE Department. Faculty, staff, and students support each other, knowing that each success lifts all of us higher.



MechSE online

mechse.illinois.edu is MechSE's public website. Visit here for detailed info on the department's faculty, research, academic programs, classes, events, alumni, and much more.

my.mechse is an invaluable intranet site used by students once they get to campus. It contains info on internships, job opportunities, research groups, and other inside info for MechSE students.



Instructional and research labs

MechSE is home to premier instructional lab facilities that supplement your classroom education. In these labs you will see many of the theoretical concepts introduced in class brought to life. You will have opportunities for many hands-on design and experiment activities that illustrate engineering concepts in a practical setting.

Opportunities abound for students accepted into the MechSE Department. MechSE provides a deep and diverse education and an invaluable springboard to a great career.

Design Stem

Designing solutions to engineering challenges—that's what engineers do! MechSE has developed a path of courses so that students start their design experiences during the first week on campus. This hands-on design experience continues in classes each year through their Senior Design project in their final year.

Faculty

With more than 50 full-time professors, the MechSE faculty consists of high-achieving scholars dedicated to student education and innovative, cutting-edge research. MechSE faculty are internationally renowned because of their diverse research areas and excellence in teaching. In addition, MechSE faculty enthusiastically

engage undergrad students in their research programs as lab assistants.

Research

Research in MechSE is creating opportunities at the intersection of science and engineering. Our research entails substantial collaboration, either among fundamental areas within engineering, or with other disciplines such as chemistry, physics, biology, or medicine. These collaborative efforts have the potential to shorten the timeline from scientific discovery to solutions that address ongoing and ever-changing global concerns.

Collaborative Centers

Our science-based approach brings MechSE researchers into increasingly close contact with researchers in other departments, universities, and research institutions. Our faculty are major participants in activities at the department, college, and university level via world-renowned research centers. Opportunities exist for dedicated students to participate in projects that can literally have a global impact.

Labs

MechSE's wealth of research laboratories allows faculty, graduate and undergraduate research assistants, and postdoctoral and visiting scholars to conduct theoretical,



"The rapid prototyping lab is an excellent, amazing resource in the MechSE Department. You can see your products that you design, that you create, come to life with high technologically inventive machines. You can walk in and professors are there all the time to help you out and to see your design come to life. And that's what you'll be doing in industry as well, so just having it here at the university is just an amazing experience."

—Nathan Rapp, Mechanical Engineering

computational, and experimental investigations of phenomena related to materials behavior, combustion, micro- and nanomechanical systems, controls and dynamics, fluid dynamics, heat transfer, biomechanics, and much more. Our goal is to get you into our labs as early and as often as possible to participate in these exciting experiences.

MechSE Research Labs



Advanced Materials Testing & Engineering Lab
Air Conditioning Systems Lab
Analytical and Computational Mechanics Lab
Caterpillar Electro-Mechanical Systems Lab
Combustion Diagnostics Lab
Combustion Physics Lab
Computational Fluid Dynamics Lab
Convection Heat Transfer Lab
Dynamic Systems and Control Lab
Energetic Materials Lab
Engine Modeling Lab
Flexible Automation Lab
Fluid Mechanics Research Lab
Ford Automotive Science & Technology Lab
Ford Concurrent Design & Manufacturing Lab
High Temperature Materials Lab (HTML)
Human Dynamics and Controls Lab
Laboratory for Turbulence and Complex Flow

Linear and Nonlinear Dynamics and Vibrations Lab
Machine Tool Systems Research Lab
MEMS/Micromechanics Lab
Metals Process Simulation Lab
Micro-Nano Mechanical Systems Lab
Microtribodynamics and Tribology Lab
Mobile Air Conditioning Lab
Multiphase Flow Research Lab
Polymer Processing Lab
Propellant Combustion Lab
Pulse Modulation Control Lab
Quantitative Visualization Lab
Scientific Computing Lab
Simulation and Modeling of Energetic Materials Lab
Solidification Processing Lab
Three-Million Pound Testing Facility
Vehicle Dynamics & Fluid Power Controls Lab

Mechanical Engineering

One department...two great majors

Engineering Mechanics

Mechanical Engineering is among the most diverse of the engineering fields and affects almost all aspects of our lives. It embraces many areas of specialization: automotive systems; bioengineering; combustion and propulsion; design methodology and tribology; dynamic systems and controls; energy systems and thermodynamics; fluid mechanics; heat transfer; manufacturing



“Mechanical Engineering is a very broad field, so you get a little bit of everything. You get some controls, you get some manufacturing, you get some heat transfer. So, essentially, if you’re a little bit unsure of what you want to do, it’s a really good field for that. If you’re very certain of what you want to do, it’s perfect for that, too!”

—Ann Zuzuly, Mechanical Engineering

and production; materials behavior and processing; and microscale and nanoscale phenomena and systems.

Mechanical Engineering is one of the most popular majors within the College of Engineering at Illinois. This discipline has traditionally dealt with objects and systems at macroscopic length scales. As system size has decreased to the nanoscale, research efforts have focused on phenomena at surfaces and length scales that have traditionally been the domain of physics and chemistry. At the same time, mechanical engineers use a systems approach to create new ideas and products that are far-reaching in order to meet societal needs. Mechanical Engineering students can become involved in research that is pivotal, creating opportunities at the intersection of science and engineering.

Even as these advances are made, MechSE has the strength and depth to also lead advances in more traditional areas of Mechanical Engineering. Students have more opportunities than ever to excel in these areas, too.

There are several differences...

Mechanical Engineering has requirements in heat transfer, manufacturing, machine design, and controls

Mechanical Engineering is a larger program (~783 students) than Engineering Mechanics (~113)

Engineering Mechanics has a stronger emphasis on math and physics fundamentals

Engineering Mechanics leverages this fundamental training to address engineering problems

...but many more similarities



Both majors lead to outstanding opportunities for employment or grad school

Engineering Mechanics is the study of forces that act on bodies and the resultant motion that those bodies experience. With its roots in physics and mathematics, engineering mechanics forms the basis of all the mechanical sciences—mechanical engineering, civil engineering, aerospace engineering, materials science, and related disciplines. It provides the “building blocks” of statics, dynamics, strength of materials, and fluid dynamics, which are critical to solving many of today’s critical engineering problems.

In the Engineering Mechanics major, there is strong emphasis on mathematics and physics initially, followed by courses in statics, dynamics, mechanics of solids, mechanics of fluids, continuum mechanics, mechanics of materials, computational mechanics, and engineering design. In their senior year, students begin integrating mechanics principles with concepts from other courses in their Secondary Field Option course work.

EM students choose from many Secondary Field Options, which are groups of courses in specialized areas of concentration. For example, the Computational Mechanics option includes courses in computer engineering and numerical methods. In all, there are seven named options: Biomechanics; Computational Mechanics; Engineering Science and Applied Mathematics; Experimental Mechanics; Fluid Mechanics; Mechanics of Materials; and Solid Mechanics. Also, students with special interests can work with their faculty advisors to design personalized options.

The problem-solving ability developed by EM graduates serves them well in all walks of life. About half our EM graduates continue their education in grad school, and about half take positions in industry. Our graduates who continue into grad school find themselves well-prepared for graduate work in a wide range of studies—from medicine to materials science.



“When I was in high school, I really wanted to do alternative energy research. I wanted to be an engineer that was going to research new technology to solve new problems. So I picked Engineering Mechanics because it had more theoretical background and science classes, so that I could learn more about the physical world and use those concepts to research new technology.”

—Greg Wilk, Engineering Mechanics

Sample ME Courses

- Computer-Aided Design
- Undergraduate Open Seminar
- Thermodynamics
- Fundamentals of Fluid Dynamics
- Heat Transfer
- Engineering Materials
- Dynamics of Mechanical Systems
- Design for Manufacturability
- Signal Processing
- Mechanical Design I & II
- Energy Conversion Systems
- Refrigeration and Cryogenics
- Design of Thermal Systems
- Internal Combustion Engines
- Intermediate Thermodynamics
- Intermediate Gas Dynamics
- Viscous Flow and Heat Transfer
- Numerical Thermo-Fluid Mechanics
- Intermediate Heat Transfer
- Failure of Engineering Materials
- Mechanical Component Failure
- Kinematics and Dynamics of Mechanical Systems
- Introduction to Robotics
- Robot Dynamics and Control
- Modeling Materials Processing
- Computer-Aided Manufacturing Systems
- Numerical Control of Manufacturing Processes
- Industrial Control Systems
- Computer Control of Mechanical Systems
- Senior Design Project
- Introduction to Finite Element Analysis
- Introduction to Tribology
- Whole-Body Musculoskeletal Biomech
- Musculoskeletal Tissue Mechanics
- Mechanobiology
- Introduction to MEM Devices and Systems
- MEMS-NEMS Theory & Fabrication
- Optics Theory and Application
- EcoDesign and Environmentally Conscious Manufacturing

Sample EM Courses

- Mechanics in the Modern World
- Mechanics for Technology & Management
- Mechanics for MatSE
- Introduction to Statics
- Statics
- Introductory Dynamics
- Introductory Solid Mechanics
- Solid Mechanics Design
- Engineering Design Principles
- Behavior of Materials
- Introductory Fluid Mechanics
- Intermediate Dynamics
- Fundamentals of Engineering Acoustics
- Mechanics of Structural Metals
- Mechanics of Polymers
- Mechanics of Composites
- Intermediate Fluid Mechanics
- Viscous Flow and Heat Transfer
- Continuum Mechanics
- Intermediate Solid Mechanics
- Experimental Stress Analysis
- Cellular Biomechanics
- Computational Mechanics

Discover student life...and prepare for real life

Alumni

With an unmatched education and a huge network of companies, faculty, and fellow alumni, MechSE grads are well-armed to face the world's challenges and pursue their professional dreams. Some notable MechSE alums include:

Adam Booher (BSEM '11)



President of Bump, which provides prosthetic arms for the world's poor

Eric Brown (BSEM '98, MSTAM '01, PHDTAM '03)

Group Leader of Neutron Science & Technology at Los Alamos National Laboratory

Thomas Donovan (BSME '82)

Intellectual property attorney and partner at Barnes & Thornburg

Neel Kashkari (BSME '95, MSME '98)

Directed the U.S. Treasury's TARP Program in 2008-09

Sidney Lu (BSME '81)

Foxconn Technology Group's executive vice president

Jigar Shah (BSME '96)

Founder of SunEdison and former CEO of the Carbon War Room

Karen Thole (BSME '82, MSME '84)

Mechanical and Nuclear Engineering Department Head at Penn State

Ashley Wessendorf (BSEM '08)

Currently PhD candidate at MIT/Harvard (joint program)

Hands-On Learning

Learn By Doing

Students spend more than 150 hours in labs and collaborate with other students, grad students, and faculty.

Broad Experience

Students gain experience with a broad range of phenomena (radiation heat transfer, rapid prototyping, fluid power, metrology, microfabrication, and more).

Equipment

MechSE students utilize surface-measuring systems, stereolithography, and hydraulic test systems, among many others that are used in industry as well.

Faculty Mentors

Mentors give students a deeper understanding of engineering principles and applications, exposing them to collaboration that drives meaningful research.

Critical Thinking

Lab experiences help students to think critically about challenges they will face with real-world situations.



Organizations & Events

With 800 student organizations on campus, students have virtually unlimited choices to explore, including these that are popular in MechSE:

ASME

American Society of Mechanical Engineers promotes the art, science, and practice of mechanical engineering, and regularly hosts representatives of industry leaders such as Caterpillar, John Deere, ExxonMobil, Arcelor-Mittal, and others.

SEM

The **Society for Experimental Mechanics** focuses on projects related to mechanical principles, from the mechanics of bicycles to the construction of weapons of medieval warfare.

PTS



Pi Tau Sigma members foster the high ideals of the engineering profession and encourage development of leadership skills and civic responsibility. This includes regular outreach to schools to encourage engineering studies.

SWE

Society of Women Engineers supports women in reaching their potential in engineering and finds ways to inspire young girls to pursue engineering.

EOH

Engineering Open House is a huge annual event in which students from each Engineering department present research and projects for thousands of visitors. MechSE students can even participate in overseeing the entire event.

Design Teams

MechSE students gain invaluable experience when they join a design team, each of which creates a new design each year. Freshmen are welcome.

Formula SAE



The **Formula SAE** team builds a mini-Indy-style racer that is taken to track competition in the spring and summer.

Baja SAE

The **Baja SAE** car is a four-wheel, single seat, off-road recreational vehicle ready for rough terrain. This can get wild.

Hybrid/Electric SAE

Hybrid SAE builds a partially electric racer, giving its members unique skills sought in many emerging industries.

Eco-Marathon Urban Concept

The **Illini EcoConcept** team builds an alternative-fuel car that is nearly street legal while remaining fuel efficient.

Eco-Marathon Fuel Cell

The **Eco-Illini** vehicle looks very little like a standard car, and neither does its MPG—over 800 MPG!

Chainless Challenge



This team design, builds, and competes what is in essence a bicycle—except no chains are allowed to drive the wheel.

Career Launch

International Study

MechSE students often include **travel abroad** in their education plans. The experience of being immersed in another language and culture prepares students for leadership in an increasingly global workforce.

Internships/Co-ops

A great "foot-in-the-door," MechSE students can spend their summers working for some of the world's top companies. High-achieving students may receive multiple offers. More than 65% of MechSE students take advantage of these opportunities.

Research Park

The **University of Illinois Research Park** is home to top companies such as John Deere, Caterpillar, and Yahoo!. It also serves as an incubator for start-up companies, several of which have been founded by MechSE students, faculty, and alumni.

Research Groups



MechSE offers students the chance to work in a laboratory setting alongside researchers who are leaders in their fields. You could join a team addressing some of the most interesting and important problems of our time.

Engineering Career Services (ECS)

A full-service office, **ECS** offers resources and information about full-time positions, on-campus recruiting, career counseling, career fairs, workshops, and much more.

Facts & Figures

The following numbers are based on the most recent academic year:

National ranking

U.S. News & World report ranks the Illinois mechanical engineering program at No. 5 on its annual list.

Undergrad Enrollment

896 in total; 783 in **Mechanical Engineering** and 113 in **Engineering Mechanics**.

Degrees Granted

203 bachelor of science degrees.

Average Starting Salary

\$64,500 for students receiving a bachelor of science degree in Mechanical Engineering or Engineering Mechanics.

Research

Annual expenditures of \$25 million support MechSE faculty and students.

Placement

More than 1,700 interviews for graduating MechSE seniors scheduled by the Engineering Career Services Office. Upon graduation, approximately 95% of MechSE grads are already employed or headed to grad school.



"For anything students want to do here, they are the master of their career. I know that I changed my career decision four times about what I wanted to pursue, and I didn't have any problem. I'm still graduating in four years. It allows you to broaden your scope."

—Niket Patel, Mechanical Engineering

Engineering at Illinois - so much to offer

Engineering Campus

Engineering Campus at Illinois balances a sense of history with the state-of-the-art. MechSE students often work with students and faculty from other departments or collaborative centers.

Campustown

Centered on Green Street just outside Engineering Campus, U of I's "downtown" is full of cafes, restaurants, shops, and nightlife options.

Student Union

The historic **Illini Union** features a food court; rec room with bowling, billiards, and arcade games; cafes; lots of lounge space; a tech store; and much more.

Activities and Recreation Center

The "ARC" boasts 340,000 square feet and is one of the country's largest on-campus recreation centers.

Entertainment & Sports

U of I is home to the renowned **Krannert Center for the Performing Arts** and hosts **Division I college athletic events**. There is also an incredible local music scene.

Quality of Life

Urbana-Champaign offers a unique combination of big city amenities, such as national retailers and ethnic restaurants, and small-town traffic. It has been listed among the top U.S. tech cities and the top U.S. cities for green living.



"We're very inclusive. We're just friendly. You can walk into Mechanical Engineering Lab and if you find someone with your same textbook, you can

just go up to them and ask, 'Could we do homework together?' And they'll always say yes!"

—Val Laguna, Mechanical Engineering

The MechSE Department utilizes two adjacent classic brick buildings in the heart of the Engineering Campus at Illinois. The **Mechanical Engineering Building (MEB)** is on Green Street, which leads to the Student Union and Campustown. The **Mechanical Engineering Laboratory (MEL)** is on the picturesque Bardeen Quad, next to the Grainger Engineering Library and Engineering Hall.



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