MITMECHE

MIT

COURSE 2

Mechanical Engineering at MIT

MCMXVI

The Department of Mechanical Engineering — MechE — embodies the Massachusetts Institute of Technology's motto mens et manus, "mind and hand" as well as "heart" by combining analysis and hands-on discovery with a commitment to making the world a better place.

This strategic plan outlines the department's educational and research priorities for the coming years. By leveraging our strengths, we aspire to solve some of the biggest challenges facing our world **—** and train the next generation of mechanical engineers to develop creative products and solutions.

Who We Are

MechE has a culture of curiosity that combines a rigorous education with hands-on experience. Since classes began at MIT in 1865, MechE's faculty and students have had a passion for pushing boundaries and developing creative solutions for the world's problems — from the development of artificial skin to pioneering 3D printing technology. We will continue to make discoveries and solve problems across an array of disciplines in the 21st century.

Mission

We educate future leaders in mechanical engineering that can model, design, innovate, and solve grand challenge problems facing our society. Our students and faculty advance science and technology by discovering solutions, designing products, and engineering workflows that help make our world a better place.

Diversity

Our success in both teaching and research is greatly enhanced by cultural, ethnic, and racial diversity. Inclusion of and mutual respect for each member of our community invigorate and sustain every aspect of our mission. Our efforts to close the gender gap in mechanical engineering has resulted in near gender parity in our undergraduate population.
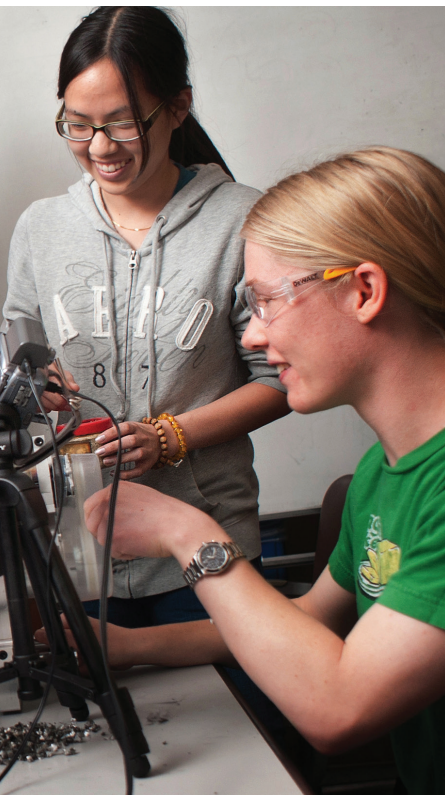
Research Areas

We conduct cutting-edge research at the new frontiers of mechanical engineering. Faculty often specialize in more than one discipline, ensuring a fluidity of research that promotes cross-disciplinary discovery.

Our research is organized across seven collaborative disciplines:

- » Mechanics
- » Design, Manufacturing, and Product Development
- » Controls, Instrumentation, and Robotics
- » Energy Science and Engineering
- » Ocean Science and Engineering
- » Bioengineering
- » Micro and Nano Engineering

MechE Alliance

The MechE Alliance, created as part of the strategic plan, is a community of students, faculty, alumni, and industry partners where connections are made, knowledge is shared, and meaningful relationships are built. The program facilitates everything from access to research to recruitment and sponsorship opportunities.

What We Do

Design and Manufacturing Innovation

Designing and manufacturing innovative products and systems that address societal challenges in health, environment, and sustainability for humanity

With technology and society changing at a rapid rate, the need for products and systems that address new challenges will continue to increase. As global leaders in both user-centered and technology-driven design and manufacturing, we create products, systems, and processes in the following disciplines:

HEALTH

Find revolutionary approaches to preventing and treating disease, illness, and the effects of aging and disabilities.

EMERGING MARKETS

Design and manufacture human-centered products that empower populations in developing nations.

SUSTAINABLE MANUFACTURING

Enable the design and manufacture of environmentally-friendly products through the creation of next-gen tools and improved product life cycles and materials, from nanoscale to large systems.

BIG DATA AND DESIGN

Use crowdsourced user information and big data to inform the design and manufacture of products.

NEXT-GEN PRODUCTION

Invent new manufacturing processes at the nexus of advanced materials, machines, and informatics such as next-gen additive manufacturing, human-machine interfaces, and automated production.

Health of the Planet

Ensuring the health and security of our oceans and environment, as well as our water and food supplies

Improving the health of our planet requires creative solutions for the many complex and uncertain issues facing our climate, oceans, agricultural production, and food and water security. The need for a sustainable planet demands integrated research efforts that develop fundamental modeling, computation, machine learning, technology innovation, and risk-management to generate practical solutions in the following areas:

ACCESS TO WATER AND FOOD

Identify new science, systems, and information technologies to provide adequate access to clean water and safe food – including desalination, water management, food safety monitoring, and irrigation.

OCEAN & ENVIRONMENT

Develop ocean technologies and advanced systems for sensing, predicting, and quantifying variability, with applications in new renewable energy, sustainable aquaculture, underwater acoustics, sea-level change mitigation, and environmental hazards.

EXPLORATION, UTILIZATION & PROTECTION

Explore, utilize, and protect our planet by conducting research in areas such as biofuels, deep-sea mining, underwater communication, clean ocean transports, drip irrigation, and digital agriculture systems.

SECURITY & INFORMATION

Develop smart sensors, data-driven systems, advanced ships and naval designs, robotics, and autonomous vehicles for the air-sea-land environment.

Grand Challenges

We have identified four unifying MechE Grand Challenges to address the biggest needs and issues facing our world. These challenges build upon our expertise and provide opportunities for major global impact through interdisciplinary collaborations. They also reflect MIT's mission to make a better world through research, education, and innovation.

Global Energy Sustainability

Developing technologies that help achieve a sustainable supply and use of energy for our world, and that also lower CO_2 emissions

Fossil fuels account for the vast majority of energy consumption. The effect CO_2 emissions has on our environment is being felt in new and alarming ways — from climate change to increasingly violent weather patterns. To address this challenge, we will combine basic energy science with applied energy technologies in the following areas:

ENERGY CONVERSION WITH STORAGE

Promote sustainability by developing clean energy technologies such as solar, thermal, wind, wave, and hybrid systems and creating improved storage capabilities including advanced batteries, fuel cells, thermal storage, and efficient hydrogen production.

EFFICIENT VEHICLES

Create solutions for vehicle electrification while also improving vehicle aerodynamics and developing low/zero carbon fuels and battery technologies.

BUILDING AND NETWORK ENERGY

Outfit smart buildings and power systems with materials and sensors that conserve energy and increase overall energy efficiency.

ENERGY-WATER NEXUS

Reduce energy consumption in water desalination, purification, and reuse. Develop technologies that reduce water consumption for power plants.

Robotics, Autonomy, and Intelligent Systems

Creating automated and smart machines and mechanical systems for health, transportation, energy, and the environment

Advances in robotics and information systems are transforming our way of life. We will continue to be at the forefront of intelligent systems, robotics, and controls research by creating smart machines and systems in the following areas:

TRANSPORTATION AND LOGISTICS

Invent disruptive technologies for self-driving cars, e-commerce automation, underwater GPS, ocean of things, optimal routing, and congestion minimization.

ARTIFICIAL INTELLIGENCE

Develop algorithms and methods for systems involving machine-learning, artificial intelligence systems, and manufacturing networks.

SMART CITIES AND INFRASTRUCTURE

Design smart buildings and self-monitoring infrastructures, and create new technologies for our increasingly interconnected world.

MEDICAL AND HEALTHCARE SYSTEMS

Invent new systems that improve medical treatment and healthcare – from wearable devices to robots in the operating room and smart drug delivery systems.

NEW SERVICE INDUSTRIES

Innovate design concepts and algorithms of robots and intelligent systems for various service industries including food, security, home appliances and delivery, healthcare, education, and entertainment.

How We Teach

Rapid developments in technology, societal shifts, and changes in the environment over the past two decades have necessitated mechanical engineers who can think critically, develop creative solutions, and remain flexible in the face of abrupt change. We encourage students to think outside the box, helping foster an innovative and entrepreneurial spirit that permeates our classrooms and laboratories.

As our department looks to educate engineers who are equipped to solve the problems of the 21st century, we are creating an educational experience that is:

Comprehensive

We ensure our students have a solid foundation in the core principles of mechanical engineering. By designing a broad, deep, and creative educational experience, we hope to create "renaissance mechanical engineers" who have comprehensive knowledge of the field.

Hands-On

We combine in-depth analysis with hands-on experience, giving students an understanding and agility that can only occur through creation. Students have access to cutting-edge tools, machinery, and software, affording them with opportunities to make discoveries, derive theories and methods, and design new products.

Career-Focused

Through career advising, networking, access to industry partners, and programs like the MechE Alliance, we prepare our students for the next decade of their life and give them the confidence they need to pursue their goals — whether that's working as an engineer, founding a company, or pursuing another degree.

Flexible

Our undergraduate and graduate programs give students the flexibility to pursue their passion while honing fundamental problem-solving skills. Undergraduates can chose between traditional or custom degrees. Graduate students have a wealth of options including a joint program with Woods Hole Oceanographic Institute, our 2N Graduate Program in Naval Architecture and Marine Engineering, and our dual degree with the Leaders for Global Operations (LGO) Program in MIT Sloan School of Management.

Get involved and learn more about MechE at
meche.mit.edu

Become a member of the MechE community through the MechE Alliance.

Join today at meche.mit.edu/alliance