Introduction

Expectations of tour guides

• Wear your TEAM polo, khakis (pants or shorts of appropriate length), closed-toe shoes, and nametag
• Arrive at least 10 minutes early to the meet in 1200J Marston if you do not have class directly beforehand
• For absences, notify your tour leader at least 24 hours in advance
• If you are sick or have an emergency, please notify as soon as possible

Introduction

• Clear the Welcome Area
• Welcome everyone to the tour
• Mention the WALKING tour and 13 different majors
• Introduce TEAM and guides

Hello! If you are here for an engineering tour then you are in the right place! Thank you all for coming. The tour is about 50 minutes and we will be touring different buildings on campus while we talk about the 13 different engineering majors offered at Iowa State. Before we get started, I’d like to take a moment to introduce ourselves. We are members of TEAM, or The Engineering Ambassador and Mentor program, which is a student organization here on campus. My name is ... (Name, year in school, major(s), hometown, fun fact). So that’s just a little bit about us, it’s an informal tour so if at any point during the tour you have questions please do not hesitate to ask any of us.

Are there any questions before we begin?

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Marston Hall (Harpole Welcome Center)

Engineering Student Services, Undeclared, Career Services, International Programs

Welcome to the College of Engineering at Iowa State. We are happy to have you all here. Please remember to keep your masks on and to practice physical distancing.

To start off the tour we would like to introduce ourselves. I/We am/are members of a student organization called The Engineering Ambassador and Mentor Program, or TEAM for short. While this tour is focused on the College of Engineering, we are willing to answer any other questions you have about Iowa State as well.

The first stop on the tour is Marston Hall. Marston Hall is the administrative home to the College of Engineering.

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Materials Engineering

Hoover Hall

Hoover Hall is the home to Materials Science and Engineering. However, it also houses classrooms and lab spaces that are used by other majors, such as Mechanical Engineering. You can also see Black Engineering Building, which houses Mechanical Engineering as well as Industrial Engineering. Because we are limiting the areas we are visiting, we will also be talking about Chemical Engineering here as well.

Materials Science and Engineering

Everything is made out of something, and that is where materials engineers come in. Materials engineering students learn about all types of materials – metals, ceramics, polymers, and electronic properties. Students will explore these materials on the scale of just a few atoms, all the way up to a full-scale part. They can use that knowledge in many different ways in their careers, such as changing existing materials to do something new and different, designing products with innovative material, or investigating quality issues or material failures.

On the third floor of Hoover, there are several research and teaching labs to further support students’ learning with hands-on experience. In these labs, students will get hands-on experience with characterization techniques and equipment, such as a scanning electron microscope, tensile testers, metallography, and thermal analysis. Mat E 444 “Corrosion and Failure Analysis” is a class that makes students use all of their skills they have gained here at ISU to investigate a series of failed parts to find the reason why they failed and how these failures can be avoided in the future.
Industrial & Manufacturing Systems Engineering

Industrial Engineering

Industrial Engineers design, develop, implement, and improve integrated systems that include people, materials, information, equipment and energy. Some of the labs industrial engineers are a part of include a manual machining lab where students learn to make an aluminum part using industrial mills, lathes, and drill presses. In the CNC machining teaching lab, students learn how to use computer aided design (CAD) software, such as AutoCAD and Solidworks, to personalize their product designs, and use computer aided manufacturing (CAM) software to create programs for CNC machining of their designs.

In the Industrial Automation Laboratory students use the technology that run today's digitally operated society, from computer controllers and RFID technology to the latest robots designed to work with, not just for, their human co-workers. Called “CoBots” for their work as Collaborative Robots, the department has a small fleet of industrial-grade cobots students learn to program to do repetitive tasks that help their human partners do their job better, faster and safer.

Another lab industrial engineers can take is a welding and metal casting lab. In this class, students learn about welding and casting-related fabrication techniques along with plasma cutting, robotic and ultrasonic welding. Students also learn to cast an aluminum Iowa State mug they get to take home.

For systems engineering applications, students learn Simio, a production planning, simulation, and scheduling tool that models complex systems. One example of a systems engineering project past industrial engineering students have had was modeling a barbeque restaurant as part of a national competition.

Facilities:

- CNC Machining Teaching Lab
- Machining, Material Testing and Polymer Teaching Lab
- Welding Teaching Lab
- Metal Casting Teaching Lab
Mechanical Engineering

Mechanical Engineering is one of the largest majors on campus, and one of the most flexible engineering disciplines: you can enter almost any industry with a Mechanical Engineering degree. Areas can include generation, distribution, and use of energy; the processing of materials; the control and automation of manufacturing systems; the design and development of machines; and more. Mechanical Engineering is spread across more than 10 campus buildings including Black Engineering, Howe Hall, and “The Hive” in Hoover Hall. The Hive is an interconnected set of collaborative design and fabrication spaces (Caterpillar and Boyd Labs) where students unleash their creativity and turn ideas into reality.

In The Hive, mechanical engineering sophomores learn how to use the power of design to make a difference in the world. They take problems from developing countries and solve them using resources native to the country. Sophomore design is unique to the Mechanical Engineering program. However, every major in the College of Engineering has a senior design class in which students work with clients on real world design challenges. Senior design is a great way for students to get hands-on experience with real problems and get their feet in the door with potential employers.

Example Sophomore Design Projects

- Laptop-Charging Backpacks
- Peanut Shellers
- Fireplace Fan Exhaust Systems

Boyd Fabrication Labs has everything you need to make ideas into reality:

- Hand Tools
- Woodworking Equipment
- Metalworking Equipment
- Welders
- Friendly and experienced technicians
- Much more
Aerospace engineering & VRAC

Howe Hall

Howe Hall is home to Aerospace Engineering as well as the Virtual Reality Applications Center (VRAC). The building houses several computer, research, and teaching labs along with club workspaces and classrooms. We will be talking more about the facilities.

Aerospace Engineering

Aerospace engineers often work on systems and study topics such as aerodynamics, controls, propulsion, and aerodynamics. Here in Howe Hall, Aerospace engineering students have the chance to work in several labs in their classes. One interesting example of this is M:2:I – “Make to Innovate.” Make to Innovate is a program that students can take from the sophomore through senior year, and can be used as a technical elective. In this class, you will be put onto a project, which could be either research-related or competition-based. Some examples of projects include UAV aircraft, rockets, satellites, and MAVRIC, which is a Mars rover team that competes with other universities throughout the United States. Students can get hands-on experience with problem-solving, designing, fabrication, and resource management. While a part of the Aerospace Engineering department, students from any major on campus are allowed and encouraged to be a part of this program.

The Aerospace Engineering department also has several wind tunnels, an icing research tunnel, and a tornado and microburst simulator along with dedicated UAV-aircraft and spacecraft senior design labs. These help students learn about several aspects from their coursework including aerodynamics and flight structures through hands-on experience.

Virtual Reality Applications Center (VRAC)

The Virtual Reality Applications Center (VRAC) is an interdisciplinary research center focused on the interaction between humans and technology, and does research in areas related virtual reality, augmented reality, machine learning, etc. One of their flagship facilities is called the C6, which is the world’s highest resolution fully immersive virtual reality environment. Powered by 48 computer workstations and 96 video cards, there are 24 projectors projecting to all four walls, the floor and the ceiling, it is used for large-scale virtual reality environments. John Deere, for example, used it for the design and visualization of next generation combine harvesters.

About 100 faculty members from across the campus and 200 undergrad/grad students work with the center. The VRAC works with the public and private sectors and some of their clients include the NSF, the department of Energy, the Army, Boeing, John Deere, Federal Highway Administration, etc. They also partner with other Universities on various research projects as well.
Agricultural & Biosystems Engineering

Biorenewables Complex

The Biorenewables Complex is home to Agricultural and Biosystems Engineering (ABE). This atrium connects three buildings. Elings Hall has office space for teachers and other staff as well as classroom space. Sukup Hall contains several computer, research, and teaching laboratories as well as classroom space. The Biorenewables Research Laboratory has lab space for several research centers.

Biological Systems Engineering

Biosystems engineers work to conserve natural resources and convert biologically based resources into useful products. Examples range from breakfast cereals to biologically derived fuels like today’s ethanol and biodiesel. Biosystems engineers improve and protect soil, water and air quality, improve the economic and environmental sustainability of bio renewable resource production systems by designing and operating industrial-scale bioconversion systems, and work to make our food safer in the realm of pasteurization, sterilization, freezing and hydration. In today’s global marketplace, grains, produce, and livestock are transported from country to country, and food security is increasingly of concern.

Agricultural Engineering

Agricultural engineering and biosystems engineering is housed in the Biorenewables Complex. Agricultural engineering takes engineering knowledge and concepts and uses it for agriculture. Agricultural engineers commonly work on large machinery, design farming methods to increase output, develop environmentally and economically sustainable animal housing and waste systems, and evaluate and design systems for sustainable agriculture to help improve soil and water resources. A few examples of the lab spaces that students have access to are the automated manufacturing lab, the John Deere Tractor Engine Lab, the water quality lab, Buss Hydrology Lab, and the ABE Student Innovation Center.

Facilities:

- Automated Manufacturing Laboratory
  - CNC mills
  - Metrology
- John Deere Tractor Engine Laboratory
  - Hands-on experience
  - Technical elective
- ABE Student Innovation Center
  - Waterjet
  - Club workspace
  - Design class workspace
Chemical & Biological Engineering

Sweeny Hall

The Chemical and Biological Engineering department is housed in Sweeney Hall. Sweeney Hall is across the open area from Hoover Hall. We will not be visiting it because of time limitations. Sweeney Hall has several labs, including several computer labs for students.

Chemical engineers use chemistry to convert raw materials into items that benefit the world. Chemical engineers take products developed on a lab scale and scale it up to production levels. For example, a chemist will develop the reaction that creates ibuprofen from raw materials and a chemical engineer will scale this process up in order to manufacture and package it at a scale large enough to fulfill consumer demand.

One of the labs that chemical engineers will take part in while here at Iowa State is the Unit Operations lab. In this lab students will get hands-on experience with equipment that can be found in industry after graduation.

If you would like to take some of your labs elsewhere, you can go to Oviedo, Spain where you can take a five week intensive study abroad program that will replace two semesters of your senior year unit operations labs. During this program, students work Monday through Thursday and have weekends off to travel. You do not need to know Spanish for this program, as this program is taught entirely in English.
Civil, Construction, & Environmental Engineering

Town Hall

The Department of Civil, Construction and Environmental Engineering is housed in the Town Engineering Building and offers three undergraduate degrees along with an environmental emphasis in civil engineering. The curriculums focus on experiential team-based learning that prepares students for the future and contain lab experience, opportunities for undergraduate research and design. More than 90% of CCEE students have formal internships or coop experiences before graduation. Research focuses on better ways to make life better through building today’s infrastructure with high performing sustainable materials, better design methods, high performance computing modeling and improve construction methods. Civil and construction engineers use big data to solve infrastructure issues, improve autonomous systems in transportation and construction, develop sustainable and new ways to make materials, and improve soil condition.

Environmental engineering enables students to study how to improve the quality of air, water and soil. Some of the topics that environmental engineers will learn about here at Iowa State include pollution control, water treatment design, and environmental protection and mitigation. The Joseph and Elizabeth Anderlik Teaching Laboratory is used by students to learn about water chemistry. Many rivers in Iowa are polluted and yet are our sources of drinking water. How do we develop more resilient systems for mitigating and solving this problem?

Facilities

- Geotechnical/Materials/Environmental Teaching Laboratories for hands-on experience testing equipment.
- Advanced Asphalt Materials Laboratory for developing new asphalt materials
- Two structures laboratories for investigating the capacity of new materials
- Gerald and Audrey Olson Soil Mechanics Laboratory
- Portland Cement Concrete Pavement (PCC) and Materials Research Laboratory
- Water Resource Laboratory for examining the impact of water flow and how to mitigate issues
- Environmental Engineering Research Laboratory and Instrumentation Laboratories with state-of-the-art equipment for using science and engineering to improve our environment.
Electrical, Computer, Cyber Security & Software

Coover Hall

Electrical, Computer, Software, and Cyber Security Engineering are housed in Coover Hall. Because these areas are so intertwined, students in all four majors work together in several classes throughout their time at Iowa State.

Electrical engineers work on all kinds of systems, including those for power grids, wireless communication, and the electrical systems in vehicles, planes, cell phones, and more. They design sensors, advance the security and reliability of the Internet, and they develop wind and solar energy technologies to combat climate change. Electrical engineers work on the hardware for computers and other devices we rely on to communicate, store information, and travel from one place to another.

Computer engineers are the bridge between electrical engineering and software engineering. Computer engineers know how to design and build computers and how to program them to get maximum efficiency. They also understand how programs and apps will work with the electrical components: for instance, how the hardware and software interact in a cell phone or an autonomous car. Computer engineers know both the software and hardware systems in the devices we rely on.

Because security is becoming fundamental to everything we do, we also have a separate major in Cyber Security Engineering. Cyber security engineers learn all of the programming skills that computer and software engineers do, but they also learn how to build secure software and hardware systems, to prevent hacking of sensitive data on phones, networks, and electrical grids.

An important class that all students in electrical, computer, and cyber security engineering take is CprE 288 – Embedded Systems, where teams work together in developing code for an autonomous vehicle platform to carry out a planned mission, with scenarios patterned after the tasks facing NASA’s Mars Rover. In this class, students learn how to write software that interfaces with hardware, processes data, and makes intelligent decisions.

In the software engineering major, one of the most important classes students take is SE 309: Software Development Practices. Student teams have full control over what they create. They build anything from fully functional Android apps to video games. An example of an app students created is one that allows multiple people to add to the same Spotify queue. Students often say, “This is the class that changed me from a programmer into a software developer.”

Graduates from all of these majors go on to work at places like: Facebook, Amazon, Apple, Netflix, Google, Garmin, John Deere, Microsoft, Collins Aerospace, Texas Instruments, Black & Veatch, Tesla, and more.
Student Innovation Center

The Student Innovation Center is the newest building on campus. It is an interdisciplinary building with classrooms, meeting rooms, makerspaces, and community resources all Iowa State students have access to. It’s equipped with state-of-the-art technology and equipment, with more becoming available each semester.

The makerspaces will include a heavy metal workshop, wood and light metal workshop, and an electronics, textiles and 3D printing lab. Students have access to these labs and can use the help of professional staff and student assistants to help projects come to life.

Also integrated into the design of the Student Innovation Center are club labs and spaces. Several clubs have made the Student Innovation Center their home since the space opened. A few of these clubs include Gaffer’s Guild, which is the glassblowing club on campus, and the Society of Automotive Engineers (SAE), which is a competition-based club that has several teams that build a vehicle and compete with other schools.