

# Engineering Daily Tour Script – Fall 2022

## 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 (or immediately after class) to the meet in 1200J Marston
- 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 (5 minutes before)

- Welcome everyone to the tour
- Mention the WALKING tour and 14 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 walking to six different buildings here on the west side of campus while we talk about the 14 different engineering majors offered at Iowa State.

Before we get started in 5 minutes, 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 in engineering. 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.

Please take these last few minutes to use the restrooms in the hallway, ask us any pressing questions, and before we head out, please take a second to follow us on Instagram and Facebook (they are listed on the monitors) so you can keep up on what's going on in the college long after the tour is done.

### TOUR ORDER

BUILDING	TOPIC
<b>MARSTON HALL</b>	Engineering Student Services: Undeclared, Int'l Programs, etc.; Engineering Career Services
<b>HOOVER HALL (LOBBY NEAR MAIN STAIRS)</b>	Materials & Industrial
<b>HOOVER HALL (NEAR BOYD LAB)</b>	Mechanical & Boyd Lab
<b>HOWE HALL (ENTRANCE NEAR VRAC)</b>	Aerospace & VRAC
<b>SUKUP/ELINGS</b>	Agricultural & Biosystems
<b>SWEENEY HALL</b>	Chemical
<b>COOVER HALL (OUTSIDE, NEAR MOTH STATUE)</b>	Civil, Construction, & Environmental
<b>COOVER HALL (INSIDE NEAR STAIRS)</b>	Electrical, Computer, Cyber Security & Software
<b>STUDENT INNOVATION CENTER (SIC) (*IF TIME)</b>	Workshops, club and lab spaces

# Marston Hall (Harpole Welcome Center)

## Engineering Student Services, Undeclared, Career Services, International Programs

(After a few minutes of answering questions and allowing for bathroom ...)

Welcome to the College of Engineering at Iowa State. We are happy to have you all here. If there are any guests that would like to remain here instead of walking for the next 45 minutes, please feel free to remain and we will bring the rest of your party back to you at the end of the tour. (Pause ...) OK, let's begin!

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

<p><b>Facilities/Offices:</b></p> <ul style="list-style-type: none"><li>• Classrooms</li><li>• Study Spaces</li><li>• Engineering Student Services</li><li>• Engineering Career Services</li><li>• Dean's Office</li></ul> <p><b>Engineering Student Services</b></p> <ul style="list-style-type: none"><li>• Undeclared engineering academic advising</li><li>• Engineering International Programs</li><li>• Classification</li><li>• Scholarships</li><li>• Recruitment</li></ul>	<p><b>Engineering Career Services:</b></p> <ul style="list-style-type: none"><li>• Cyhire</li><li>• Career Fair</li><li>• Mock Interviews</li></ul>
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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.

### 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 are “people” engineers and technical problem solvers. Industrial engineers design, develop, implement, and improve integrated systems that include people, materials, information, equipment and energy. Currently, the Industrial Engineering department is based in the Black Engineering building; however, in 2024 the Industrial Engineering department will be moving to its own, brand-new facility. Industrial Engineers work in every industry, including manufacturing, healthcare, banking, transportation, and entertainment. Most IE work is done in teams to find the best solutions that improve processes to help people. Sometimes these improvements are global, sometimes they are very local. Industrial Engineers often become engineering managers, directing other engineering professionals because they have the skills necessary to optimize systems.

Focus areas for Industrial Engineering include Systems Engineering and Engineering management, learning the skills to solve internal and external problems of a company; human factors, learning about the relationship between people and their work tasks; Operations Research and Analytics; learning how to make engineering decisions based on production in service systems such as logistics and inventory control; Manufacturing, learning how to design and optimize industrial processes and systems; and Enterprise Computing, learning how to integrate and use information among multiple units of an enterprise.

Industrial Engineering courses include extensive hands-on labs. Students have the opportunity to pour molten aluminum, simulate systems, design processes, and program co-ops. Undergraduate research opportunities include areas such as virtual reality, software user interfaces, laparoscopic surgery ergonomics, automation, or clean energy.

At Iowa State, we offer a unique opportunity between the College of Business and the College of Engineering called the Concurrent Master’s in Business Administration program. In this program, students graduate in 5 years with their undergraduate in engineering and their MBA. The first 3 years are focused on engineering coursework, while the last 2 are a combination between engineering coursework and MBA courses. This is currently offered with 12 of the 14 engineering majors.

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

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. At its core, mechanical engineering is learning how to convert raw energy into useable products utilizing design techniques.

A degree in Mechanical Engineering can be catered to each student's interests with a wide variety of technical elective courses that a student can take, ranging from courses in robotics and advanced design to management and entrepreneurship. The possible career fields for a Mechanical Engineer are wide, popular career choices are product development engineering, project engineering, and quality engineering. The Mechanical Engineering department is also offering a new minor called Cyber-Physical systems, where students learn how to connect physical entities to cyber entities, such as robotics, machine learning, and autonomous vehicles.

Mechanical Engineering is spread across a few 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.

### Aerospace Engineering

Aerospace engineers often work on systems and machines that move through a fluid or have a fluid flowing around it, such as air, water, or the vacuum of space. They study topics such as 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:2:1 – “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 classwork 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. Agricultural engineering and biosystems engineering is housed in the Biorenewables Complex.

## **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.

There are three specialization options in biosystems engineering. The first is Bioenvironmental, which applies biology and engineering principals to improve and protect soil, water, and air quality. There is also Biorenewable Resources, which lessens environmental impact through economic and sustainable processes. Lastly, Food Engineering is working to make our food safer in the realm of pasteurization, sterilization, freezing and hydration through the design and operation of modern food processing systems. In today's global marketplace, grains, produce, and livestock are transported from country to country, and food security is increasingly of concern.

There are many notable student organizations within Biological Systems Engineering, one of them being the ISU Biobus club. In this organization, students recycle excess vegetable oil from Iowa State dining centers and convert it into biodiesel fuel to power a CyRide bus. They have their own laboratory space in the Biorenewables Lab.

## **Agricultural Engineering**

Agricultural engineering takes engineering knowledge and concepts and uses it for agriculture. There are also three focus areas within agricultural engineering. The Power Machinery focus area designs and improves upon the next generation of off-road vehicles and agricultural equipment such as tractors and ATVs. Land and Water Resources Engineers evaluate and design systems for sustainable agriculture to help improve soil and water resources. Lastly, Animal Production Systems Engineers develop environmentally and economically sustainable animal housing and waste systems. There are about 7 pigs to every person in Iowa, and they all need a place to live. Animal Production System engineers find safe and sustainable ways to do this.

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. The John Deere Tractor Engine Lab is a lab in which students study the thermodynamic principals and construction of tractor engines through hands-on experiences. The ABE Student Innovation Center features a Waterjet, club workspaces, and design class workspaces for students.

# Chemical & Biological Engineering

## Sweeney Hall

The Chemical and Biological Engineering department is housed in Sweeney Hall. 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, and can go into many industries such as cosmetics, food products, and pharmaceuticals. 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. This is a 1-year lab where you will get hands-on experience with equipment that can be found in industry after graduation. A notable feature of the lab is the pilot-size distillation column, which students learn about in class and then get to use in lab. Understanding separation processes is an important part of Chemical engineering.

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.

### Construction Engineering

Construction engineers blend engineering, management, and business sciences into a study of the processes of construction and have the ability to interpret design plans and bring them to life. Construction Engineering has four focus areas, the first being building. The building emphasis teaches students how to manage and construct commercial and residential buildings, which includes planning, estimating, and scheduling projects. The Mechanical and Electrical focus areas cater to the development of mechanical and electrical systems such as heating and ventilation systems and sound systems within a structure. Lastly, Heavy or Highway engineering focuses on the construction processes of large infrastructure, such as highways, bridges, and dams.

### Civil Engineering

Civil Engineers design, build, and maintain the infrastructure of our modern society. Under civil engineering falls a wide range of career options, such as structural engineering, transportation engineering or geotechnical engineering. Structural engineers develop structures such as bridges, buildings, and dams. Transportation engineers use big data to design and develop roadways that can safely and efficiently transport people on. Geotechnical engineers analyze the mechanics of soil and rock to design and build foundations for structures.

### Environmental Engineering

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. Environmental engineers work to design resilient systems for mitigating and solving this problem.

Along with many laboratories for hands-on experiences, more than 90% of CCEE students have formal internships or coop experiences before graduation. As a whole, 74% of engineering students at ISU graduate with professional engineering work experience, as well.

# 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 engineering is the study of how to create electrical hardware and how to control electricity in a variety of environments. Electrical engineers can design computer chips, sensors, control the electrical grid, and build lasers and nanotechnology devices, and build medical devices. By using a basic set of knowledge about electromagnetics, controls, and electrical components, Electrical engineers are critical to industries like railways, computer hardware design, renewable energy, audio production, building design, and many more.

Computer engineers work at the interface between hardware and software. Computer engineers learn how to program computers beneath the level we interact with, allowing us to make and develop modern applications. Computer engineers can also understand how to integrate complex computer systems and sensors, which can be seen in applications like cars, planes, and HVAC systems. Computer engineers are at the cutting edge of autonomy, the Internet of Things, and machine learning

A demand for Cyber Security professionals increased due to the rise in security threats in technology systems and the increase of sensitive data that technology uses. This led to Cyber Security Engineering becoming its own independent major here at ISU. Cyber security engineers use computer and software skill to protect systems from threats and attacks on both hardware and software systems.

An important class that students in electrical, computer, and cyber security engineering take is CprE 288 – Embedded Systems. In the lab students program a rumba robot to make it perform different tasks using the sensors and other available features. At the end of the semester students will program the rumba to navigate a mock mars rover obstacle course. Students must use the onboard sensors to detect and avoid obstacles.

Software Engineers take computer science principals and apply an engineering lens to them. They focus on things like, lifecycle development, collaboration, and adaptation. One important class that software, computer and cyber security engineering students take is COMS 309: Software Development Practices. In this class students work in a team of four to create an app. An example of an app students created is one that allows multiple people to add to the same Spotify queue and vote to move songs higher up the in the playlist queue. This class focuses on collaboration and communication with weekly progress report meetings. Students often say, “This is the class that changed me from a programmer into a software developer.”

\*\*\*Here ends the daily visit tour. Please assist families by pointing towards their next destination and assisting them as needed. Then, return to 1200 Marston Hall for postcard writing.

# 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, PrISUm (ISU's solar car team), and the Cardinal Space Mining Club which builds a competitive robot and competes in an annual NASA competition. Another primarily-engineering focused competition team, the Society of Automotive Engineers (SAE), has five divisions – Aero, Baja, Clean Snowmobile, Formula, Supermileage.