Northeastern University
College of Engineering

*STEM Newsletter 23 - **Careers in Engineering** (11.16.2020)*

Introduction

Engineering is the application of science and mathematics to design and build machines, structures, and other structures. In the United States, the most popular engineering degree is mechanical engineering. Generally, mechanical engineers research, develop, design, build, and test various devices, allowing this to be considered one of the broadest engineering branches. Mechanical engineers apply principles of motion, energy, and force to their work. There are a variety of disciplines within mechanical engineering including aerospace, biotechnology, cybersecurity, design, energy, production planning, robotics, and many more. An example of the work mechanical engineers do include designing machines inside of buildings such as escalators and elevators.

Electrical engineering, dealing with electronics and electricity, is a relatively young, but rapidly growing field of engineering. Electrical engineers apply the physics and mathematics of electricity, electromagnetism, and electronics to both large and scale systems to process information and transmit energy in order to design and develop new electrical systems. Electrical engineers work in transport networks, lighting, heating, ventilation, lift systems, power generation and distribution, renewable energy, manufacturing, and construction.

On the contrary, civil engineering is one of the oldest fields of engineering. A civil engineering program focuses on applying mathematics and physical science to solve specific, real-world problems in commerce and industry. Civil engineers conceive, design, build, supervise, operate, construct, and maintain infrastructure projects and systems in the public and private sectors. Their work includes roads, buildings, airports, tunnels, dams, bridges, and systems for water supply and sewage treatment. There are various subdivisions of civil engineering including, construction and management engineering, geotechnical engineering, structural engineering, transport engineering, and water engineering.

Chemical engineering is another engineering discipline that is rapidly growing. Chemical engineers apply the principles of chemistry, biology, physics, and math to solve problems that involve the production or use of chemicals, fuel, drugs, food, and many other products. A

degree in chemical engineering requires the combination of natural and experimental sciences along with life sciences and mathematics. This field translates chemical information to formulate designs.

Other engineering fields include computer engineering, biomedical engineering, and industrial engineering. Computer engineering integrated electronic engineering with computer sciences in order to design and develop computer systems. Biomedical engineering, also known as bioengineering, applies engineering principles to design biomedical equipment and devices. Industrial engineers apply science, mathematics, and engineering methods to complex system integration and operations. There are numerous disciplines of engineering, but all disciplines integrate a variety of sciences into the physical world in order to benefit society. Each of these disciplines can also be broken down into various branches. Engineering is an extremely broad field that is capable of including all interests and studies.

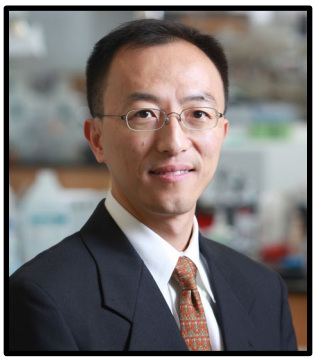
Northeastern Connections

Faculty Connection

Northeastern has a plethora of resources and opportunities for students to explore their career options. Students have assigned academic and co-op advisors to aid in their decisions. The Employer Engagement and Career Design Office has trained peer advisors as well as professional staff available to help plan their future steps. There are many student organizations to get hands on engineering experience as well! The most well known way to explore the many engineering careers is by going on co-op, where students spend a period of time employed full time to gain real life experience in a professional setting.

Northeastern's diverse engineering faculty are a great representation of the many career paths engineers can take.

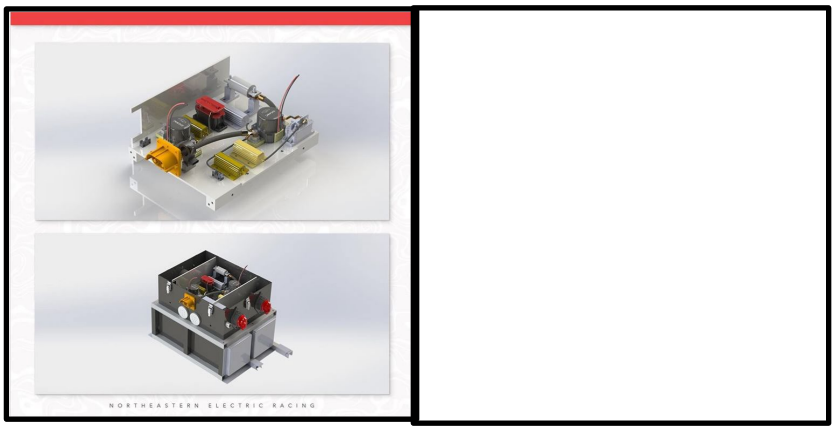
Mechanical and Industrial Engineering Professor, James Benneyan has focused his research in healthcare systems engineering - specifically topics such as "quality and reliability engineering, statistical quality control, and patient safety". His focus in healthcare systems can also be seen in his position as a Director of the Healthcare Systems Engineering Institute.



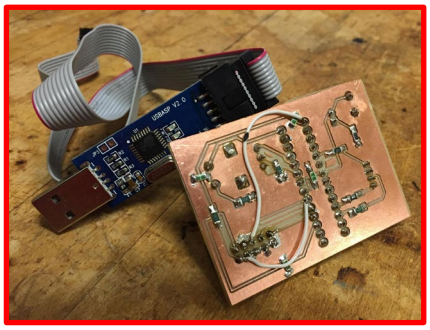
Bioengineering Associate Professor, Guohao Dai has focused his research on "3-D bioprinting technology, stem cells technology and vascular bioengineering". Recently, Dai has been working on a 3-Dimensional model to aid in the study of brain tumors and potentially finding cancer treatments.

Student Connection

The Electric Racing Team is a student organization that explores the process of designing, building, and racing an electric car. The club allows students to get their hands dirty with some first-hand experience of automotive technology.

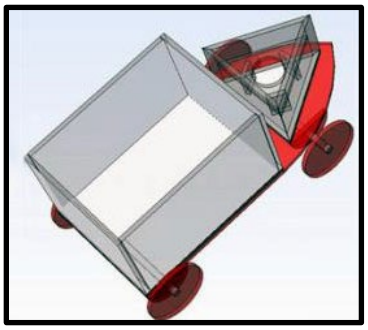


Recently, they've completed their constant-velocity axle system design and battery box seen on the left.



The NU Wireless Club's goal is to help "students learn more about electronics and pursue their interests in amateur radio." With their very own lab space and full amateur radio station, students can tackle their own projects and learn about electronic and computer technology through hands-on experience.

ChemE Car spends the year designing a chemical reaction powered car for the national ChemECar Competition. With new set of guidelines each year, students have to be creative and rely mainly on chemical kinetic rather than typical mechanical and electrical methods.



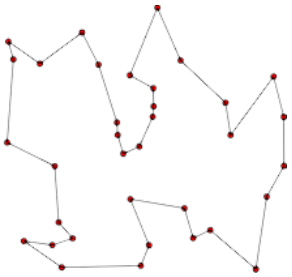
a

the

Northeastern's Concrete Canoe Team prepares and participates in the annual American Society of Civil Engineers Concrete Canoe Competition, where students design, construct, and race a canoe made of lightweight concrete. The canoes must be able to hold the weight of up to 4 rowers and handle endurance and speed races in order to win. This project provides a hands-on experience as well as a leadership opportunity.

Do Now

Engineering can be found everywhere. From the Golden Gate Bridge to the newest IPhone to the life-saving vaccine, engineers work hard to solve everyday problems and improve the quality of life. However, there isn't just one engineer that solves all of our problems. There are many fields that an engineer can concentrate and find careers in. Some include, but are not



limited to, mechanical engineering, electrical engineering, industrial engineering, etc.

Watch the video below to learn more about what is an engineer and the different types of engineers.
https://youtu.be/owHF9iLyxic

- Pick a type of engineer that was not listed in the video (Hint: Search up "Types of Engineers") and answer the prompts below.
- What do those engineers do? What problems do they try to solve?
- Name one famous engineer in that field. What did they do and how did it improve the quality of life?

Activity

Engineers aren't limited to one path or one job, not all jobs in Engineering need to have a degree in engineering, and not all people with degrees in engineering become engineers. Let's take a look at chemical engineering as an example:

Job options

Here are some jobs directly related to Chemical Engineering that someone with a Chemical Engineering degree can work as:

- Chemical engineer
- Energy engineer
- Nuclear engineer
- Petroleum engineer

And here are some Jobs where this degree would be useful in:

- Environmental engineer
- Materials engineer
- Production manager
- Quality manager
- Waste management officer
- Water engineer

Taken from: Prospects.ac.uk

Let's do an activity that is related to chemical engineering, but can also relate to other engineering types because engineering cannot fit into just one box.

In this activity, we'll be looking at making a successful landfill. This relates to the Waste Management Officer and the Environmental Engineer jobs above, as well as taking the role of some Civil Engineers.

Source : Teach Engineering

Materials Needed:

You can use any materials you want but here are some suggestions:

- clear plastic tub (~12-in long × 6-in wide × 5-in deep)
- clay or silty soil from your backyard
- sand (~1500 cm3) (available at home and garden stores)
- gravel (~100 cm3) (available at home and garden stores)
- 15 cotton balls
- food coloring
- clear plastic tub for mixing
- toothpicks
- straws
- popsicle sticks

- cups
- watering can, or water bottle with holes poked in cap (optional)
- Electric or paper fan (optional)

Steps:

- Pour some sand into your larger tub and put small houses or paper to represent a town on one side. Use the mixing bowl to mix cotton balls, food coloring, and water to make the “waste” (use the images below as a reference).

- Build a landfill that minimizes the cost (does not use that many materials) while also ensuring that it can hold and contain a lot of waste.
- Use the materials to build your landfill! Your landfill should store the cotton balls (so build your landfill, fill it with the cotton balls, then cover it).
- You can check if there are any food color leaks in the surrounding sand to see if the landfill was successful.
- You can use a fan or pour some water on it to see if your landfill still stores the waste in bad conditions!

Discussion Questions:

- How many materials did you use to build it? Should you have used more or less?
- Did you have any food color leaks? Did the waste reach your town?
- What was the role of the Waste Management Officer in this activity? What about the other jobs mentioned at the start of the activity?

Share Your Results

We'd love to know how the activity and/or the "do now" turned out! What worked and what didn't work? Please share with us something you learned and/or send us pictures! Email us at stem@northeastern.edu.

Related links/Extensions

- Prospects.ac.uk -- What can I do with my degree?
- The Best Schools -- Engineering Careers
- All About Careers -- Engineering
- 14 Types of Engineering Careers to Explore
- What can you do with an Engineering Degree?
- Exciting Careers with an Engineering Degree
- Northeastern Careers
- Northeastern Careers -- Civil and Environmental Engineering
- Northeastern Careers -- Chemical Engineering
- Northeastern Careers -- Electrical and Computer Engineering
- Northeastern Careers -- Mechanical and Industrial Engineering
- Northeastern COE Faculty Directory