Types of Engineering

FOUNDATIONS OF ENGINEERING & TECHNOLOGY

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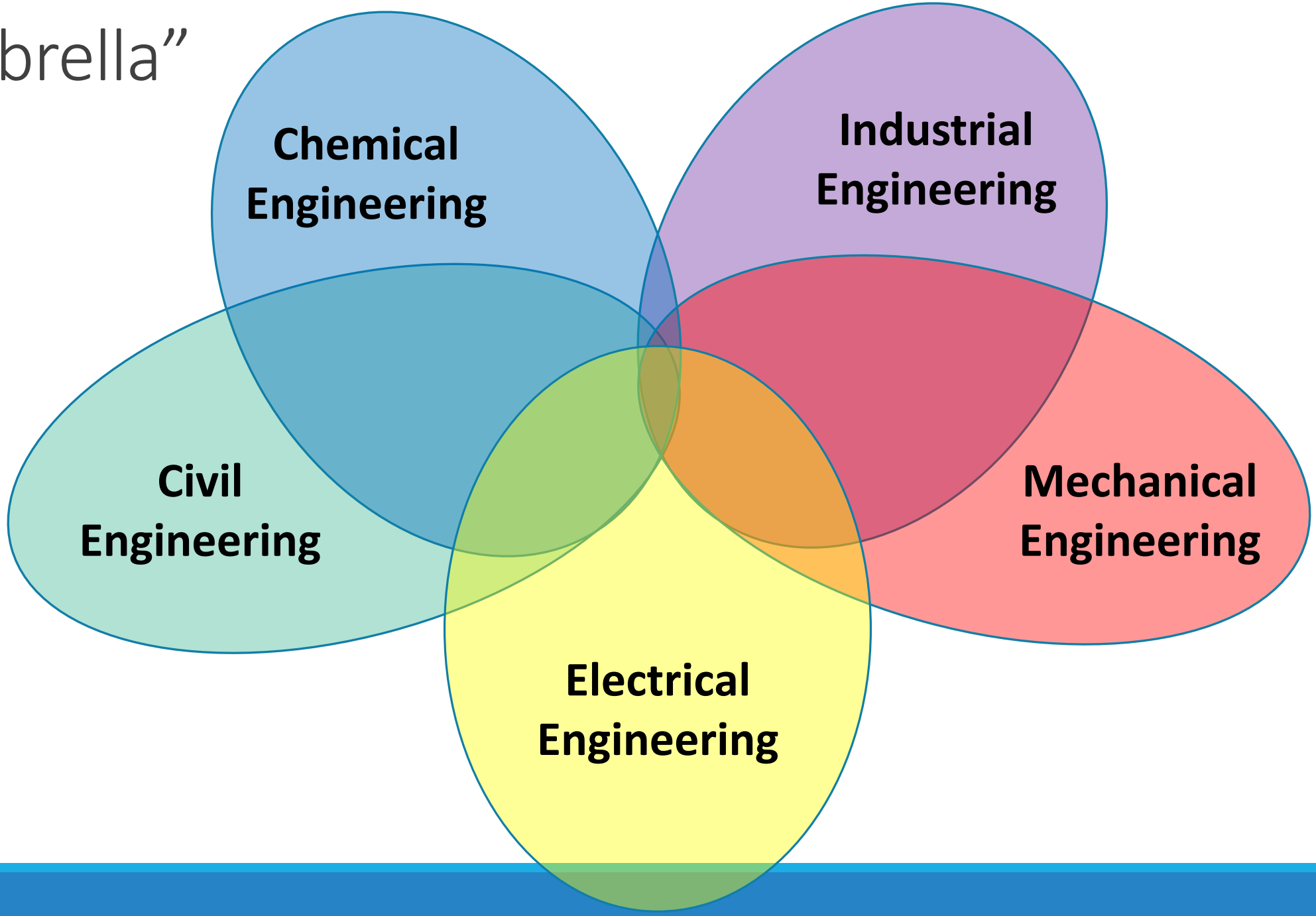
Origins of Engineering

Word origin: Engine’er (someone who operates an engine)

Originally was used in reference to military applications inventions

- First engineering was Civil Engineering (Think “Civil”ian vs Military Engineering)

Major “Umbrella” Disciplines



Civil Engineering

Designing and supervising the construction of roads, buildings, airports, tunnels, bridges, and water and sewage systems

Civil Engineers

Environmental Engineers

Agriculture Engineers

Construction Engineers

Civil Engineering

Designing and supervising the construction of roads, buildings, airports, tunnels, bridges, and water and sewage systems

Main objective: design systems that are functional, efficient, durable, and minimize harm on the environment

Structural engineers are the most common type of civil engineers. They are concerned with the integrity of the structure of buildings, highways, and bridges

Other types of civil engineers are transportation engineers, surveyors, urban planning engineers, and construction engineers

Environmental Engineering

Apply engineering principles in order to improve and maintain the environment

Uses science to make the world a safer place for humans and animals

3 components of environmental engineering:

- Disposal – disposing industrial and residential waste
- Remediation – cleaning a contaminated site
- Prevention – reducing or eliminating the amount of waste from the manufacturing process

Requires knowledge of engineering fundamentals and environmental laws and regulations

Construction Engineering

Concerned with the management and operation of construction projects

Interested in improving construction methods and materials to make them safer, more reliable, cost effective, and environmentally friendly

Incorporate technical, financial, and legal requirements into a plan to meet project deadlines

Requires project management skills and knowledge of computer tools

Agricultural Engineering

Concerned with the production and processing of agricultural products, which are critical to our ability to feed the ever-expanding world population

Can specialize in many fields:

- Power machinery
- Bioengineering
- Soils and water
- Electrical technologies
- Food processing

An example of an agricultural engineer's work is designing and implementing an irrigation system for crop production

Mechanical Engineering

Design, produce, operate, and service machines and mechanical devices

Mechanical Engineer

Acoustic Engineer

Automotive Engineer

Aerospace Engineer

Mechanical Engineering

Design, produce, operate, and service machines and mechanical devices

Second largest engineering discipline after electrical engineering

Often involved in automating time-consuming or expensive procedures

Composed of 2 main divisions:

1) Design and controls is concerned with:
   - The strength of machine parts and the stress that each part will be subjected to
   - Developing tools that help the design engineer design a machine
   - Controlling machines through mechanical, hydraulic, and digital controls
   - Minimizing the unwanted noise of a machine

2) Thermal science is concerned with:
   - The flow of fluids and energy between systems
   - Study and predict the temperature of machines parts, and design cooling devices for them
   - Heating, ventilating, and air conditioning of buildings
   - Performance and efficiency of large power generation plants, and developing alternative energy sources

Acoustical Engineering

Plan, perfect, or improve the sound of an architectural space

Investigate how different noises and background sounds affect productivity in a building

Work on an architectural space can range anywhere from examining the innumerable surfaces in a church to drawing CAD plans for a subwoofer enclosure

Automotive Engineering

Plan, coordinate, and implement the specifications for a new car, engineering every part

Design and draw automotive parts

Combine the automotive parts into components

Integrate the components into the car’s systems

Make the mechanical aspects of the car fit into the aesthetic design

Aerospace Engineering

Design, develop, test, and help manufacture aircraft, missiles, and spacecraft

Develop new technologies for military and commercial use

Can be divided into 2 fields:

- Aeronautical engineering: works will aircrafts
- Astronautical engineering: works with spacecrafts

Can specialize in many fields, ranging from propulsion to thermodynamics

Electrical Engineering

Responsible for the design, development, testing, and supervision of the manufacturing of electrical equipment, such as household appliances or guidance systems for satellites

Electrical Engineer

Software Engineer

Robotics & Automation Engineer

Computer Engineer

Biomedical Engineer

Electrical Engineering

Responsible for the design, development, testing, and supervision of the manufacturing of electrical equipment, such as household appliances or guidance systems for satellites

Work with all products and systems that use electricity

Concerned with making their designs efficient, long lasting, cost-effective, and safe

The most populated of the engineering disciplines

Can be divided into 8 areas:

Computers

Circuits

Instrumentation

Communications

Control

Signal Processing

Bioengineering

Power

Software Engineering

Responsible for the coding of computer software that results in a simple and friendly environment for computer users

Can create programs for internal office use or coordinate technical systems and growth within a company

One of the fastest growing professions in the United States

Unlike many other engineers, software engineers work in a large office setting

Robotics and Automated Systems Engineering

Concerned with programming robots and systems to perform tasks autonomously

Design more efficient and skilled robots to assemble complex products and operate spacecrafts

Requires competency in many programming languages and UNIX operating systems, as well as the ability to work in a team and communicate effectively

Computer Engineering

Design and build computer-related hardware products for many applications, such as personal computers, cell phones, automobiles, and even washing machines

Apply the theories of science and mathematics to design hardware, software, networks, computer chips, and processors

Often work in teams

One of the fastest growing disciplines

Difference between computer science:

- Computer scientists focus on software and its optimization
- Computer engineers focus on computer hardware or the machine itself

Security is becoming a huge concern of computer engineers

Chemical Engineering

Take what chemists do in a laboratory, apply fundamental engineering, chemistry, and physics principles, and design and develop processes to produce products for use in our society

Related Engineering Fields

Material Science Engineering

Nuclear Engineer

Petroleum Engineering

Biomedical Engineering

Chemical Engineering

Take what chemists do in a laboratory, apply fundamental engineering, chemistry, and physics principles, and design and develop processes to produce products for use in our society

Solve problems that involve the production and use of chemicals

Focuses on chemistry and the chemical nature of products and processes, unlike other disciplines

Design of large-scale chemical production facilities is the most common employment

Must develop processes that minimize harmful waste since many chemicals and their byproducts are dangerous to people and the environment

Materials Science Engineering

Develop new materials, improve traditional materials, and produce materials that are economical and reliable through synthesis and processing

Concerned with 4 components of materials:

- Structure – study the molecular bonding and chemical composition of materials
- Properties – optimize the strength, crack growth rates, hardness, and durability of materials
- Processes – different processes of creating materials give materials different properties, so materials engineers design processes that give each material its desired properties
- Performance – ensure that a material meets its performance demands by designing test procedures that make sure these requirements are met

Work with materials such as metals, ceramics, plastics, and composites

Nuclear Engineering

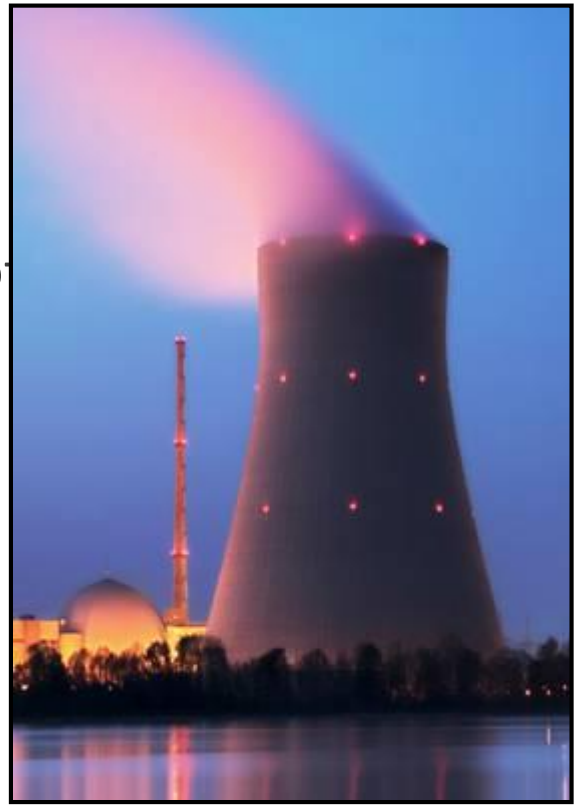
Study nuclear energy, radiation, and their beneficial uses

Work in nuclear plants to design and operate reactors

Responsible for the production of nuclear fuel and safe disposal of radioactive waste

Integrate nuclear power in the propulsion systems of ships, submarines, rockets, and satellites, which allows them to go years without refueling

Find ways to use radiation to improve the medical and agricultural fields.



Petroleum Engineering

Concerned with maintaining the safe flow of petroleum, exploring for crude oil deposits, removing and transporting oil, and refining oil

Design and operate oil drilling equipment and facilities, both on land or on offshore platforms

Extract oil safely and in a way that minimally harms the environment

Design and operate the chemical process of refining petroleum into other products, like gasoline, motor oil, lubricants, and plastics

Industrial Engineering

Design, improve, and install integrated systems of people, materials, and energy

Industrial Engineers

Industrial Engineering

Design, improve, and install integrated systems of people, materials, and energy

Involves the integration of technology, mathematical models, and management practices

Traditionally work on a factory floor, but skills can be applied to many other applications and industries

Focus on 4 main areas:

- Production is concerned with optimizing product production by reducing cost and production time, and increasing quality and reliability
- Manufacturing addresses the concerns of each individual station in the production process and optimizes the actual material processing
- The human factors area studies the interfaces between people, machines, and objects
- Operations research involves mathematically modeling systems to identify ways to improve them

Engineering Technicians

a person trained in a specific area of engineering and possesses the skills and experience necessary to perform their given tasks.

Works with Engineers

Often does not require an Engineering degree

~entry level Engineering job