



KHALIFA
UNIVERSITY



ENGR110

Introduction to Professional Engineering

Branches of Engineering



BRANCHES OF ENGINEERING

1. Aeronautical and Aerospace Engineering
2. Agricultural Engineering
3. Biomedical Engineering
4. Chemical Engineering
5. Civil Engineering
6. Computer Engineering
7. Environmental Engineering
8. Electrical Engineering
 - Communication Engineering
 - Electronic Engineering
 - Power Engineering
9. Industrial and Systems Engineering
10. Materials Science and Engineering
11. Mechanical Engineering
12. Nuclear Engineering
13. Petroleum Engineering
14. Software Engineering
15. Systems Engineering

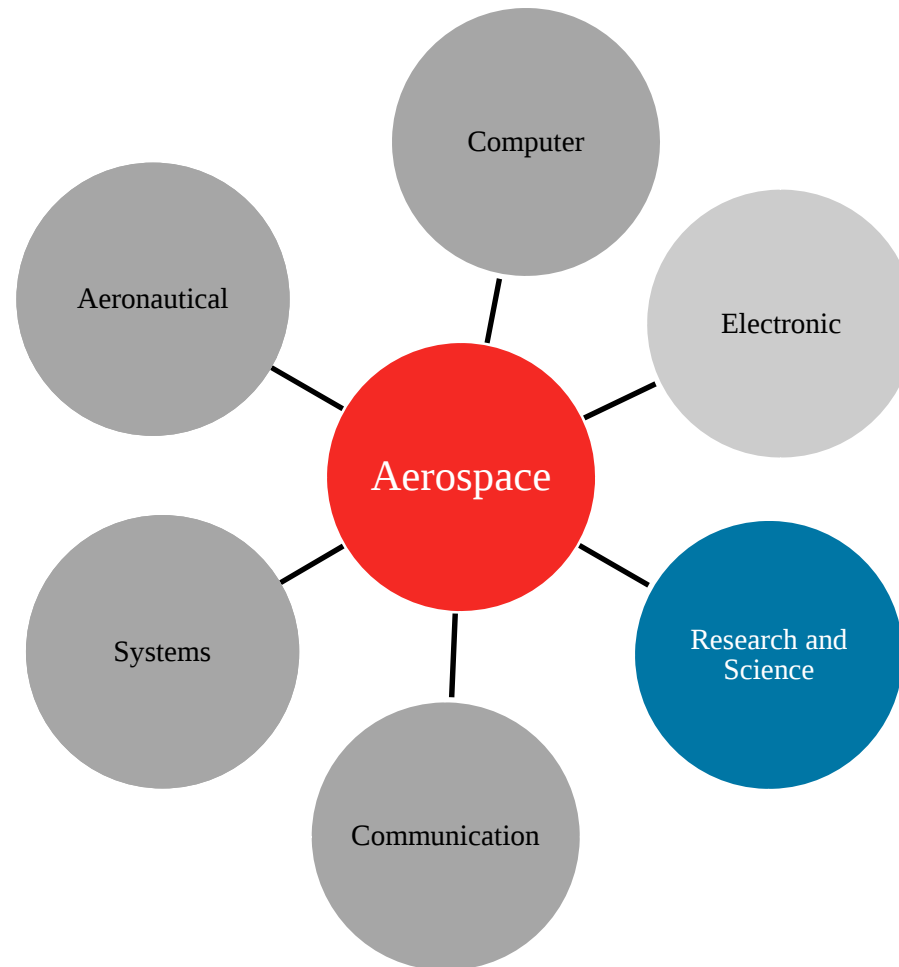


AERONAUTICAL AND AEROSPACE ENGINEERING

- Aeronautical engineering is the application of scientific principles to **flight or other movement in the atmosphere.**
- Aerospace engineering is concerned with **flight outside the atmosphere.**
- Focus of aeronautical engineering
 - design, development, and manufacture of airplanes, helicopters, and high-speed ground transportation systems.
- Aerospace engineering
 - Sometimes used more to designate all engineering activities in the broad industrial sector known as *aerospace*



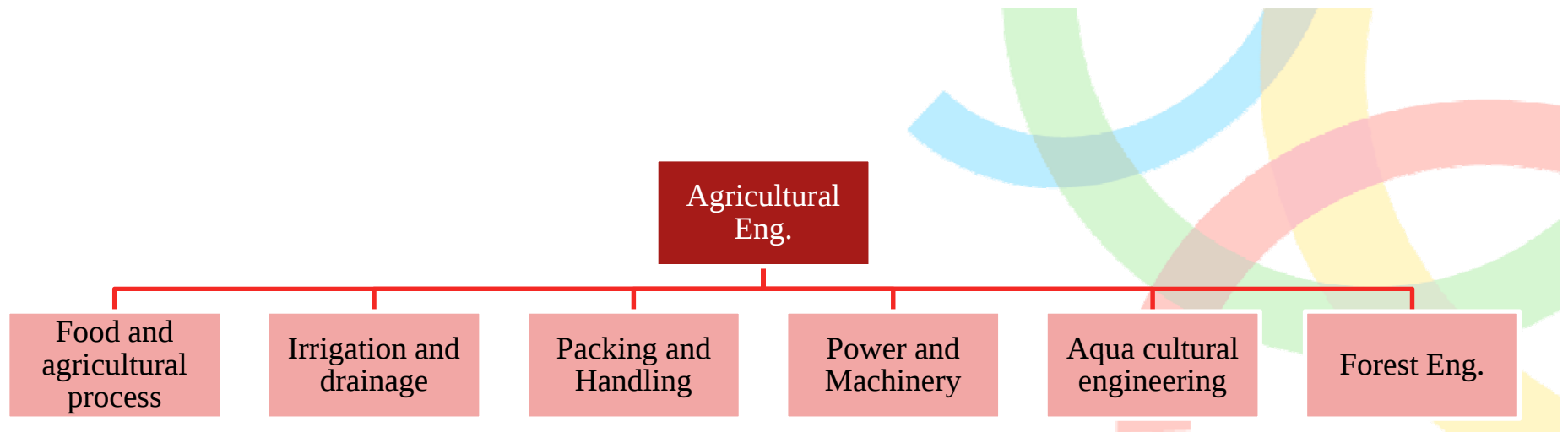
AEROSPACE ENGINEERING



AGRICULTURAL ENGINEERING

- Agricultural engineering apply engineering principles to problems of:
 - ✓ Food & fiber production, storage, processing
 - ✓ Animal and plant environment
 - ✓ Agricultural waste management
 - ✓ Irrigation and drainage
 - ✓ Other phases of agricultural and related industries
- This area is unique in that it requires general understanding of **biological, soil-management, and environmental aspects** of agriculture, plus knowledge of **engineering fundamentals**.





BIOMEDICAL ENGINEERING

- Biomedical engineering is relatively new field and consists essentially of three segments:
 - Application of engineering concepts to **biological phenomena** sometimes refer to as “bioengineering”
 - Application of engineering to the **development of instrumentation, materials, artificial organs**, frequently called “medical engineering”
 - Application of engineering to the **improvement of health delivery systems**, sometimes called “clinical engineering”



CHEMICAL ENGINEERING

- Chemical engineers apply **chemical, physical, and engineering principles** to the process of converting raw materials or chemicals into more useful forms.
- Their work ranges from **pharmaceuticals** to **fuels** to **industrial chemicals**
 - includes energy conservation and pollution control.
- Emphasis on **chemistry** and **chemical nature** of everything we use
- An important field for chemical engineers is the **semiconductor industry**.



CIVIL ENGINEERING

- Civil engineers are primarily responsible for **planning** the **design** and **construction** of all constructed facilities.
- Plan, produce, and help operate the **transportation system**.
- Develop, yet conserve, **water resources**.
- Have large role in designing **environmental protection** relating to water, air, and solid wastes.
- Involved in **housing and urban development**.
- Visible work of civil engineers are **major structures** such as highways, bridges, dams, tall buildings.
- Parts of civil engineering are:
structural, environmental, transportation, water resources, and construction engineering



COMPUTER ENGINEERING

- Computer engineering has emphasis on **the organization and design of computing systems.**
- Computer engineers participate in:
 - Computer architecture and operating systems
 - Computer networks
 - Logic design
 - Algorithm development
 - Microprocessor technology
 - Computer-aided design
 - Computer and information security
 - Chip design and fabrication



ENVIRONMENTAL ENGINEERING

- Environmental engineering is a subtopic in agricultural, chemical, civil, mechanical, or electrical engineering.
- Agricultural: irrigation, **water quality**, pesticide control, and disposal of animal wastes.
- Chemical: water quality, **controlling pollution**, air pollution problems, engines and energy conversion processes, refineries and chemical plants.
- Civil: **water quality**, **handling of waste** water in municipal or industrial treatment plants, solve problems of solid waste disposal as in sanitary landfills.
- Mechanical: air pollution problems, **engines and energy conversion** processes.
- Electrical: **electromagnetic pollution**



ELECTRICAL ENGINEERING

- Electrical engineering is extremely broad, and the Institute of Electrical and Electronics Engineers (IEEE) is the largest engineering society
- Power: power generation, power transmission, electric motors, and electrical systems for buildings and civic use.
- Electronic: design, development of electronic systems
 - Circuits and devices, control systems, semiconductor technology
- Communication: antenna and propagation, wireless technology, broadband telecommunication, communications signal processing



INDUSTRIAL ENGINEERING

- Industrial engineering is an interdisciplinary field involving **applications in industrial, service, commercial, and government activities.**
- Institute of Industrial Engineers views its members as engineers “concerned with the **design, improvement, and installation of integrated systems of people, materials, and energy.**”
- Major field in which industrial engineers work are:
 - Planning of machines, equipment, labor supply availability, transportation of raw materials and finished goods, and provision of services.



MATERIAL SCIENCE AND ENGINEERING

- Material science is concerned with understanding the **properties and behavior of materials**.
- Development of new materials or those with improved characteristics.
- Material engineers and scientists are involved with such things as the **investigation of fractures, fatigue, corrosion damage, and radiation damage**, as well as methods of **production of new materials**.



MECHANICAL ENGINEERING

- Mechanical engineers apply principles of two of the fields of physics – **mechanics** and **heat** – to the **design of machines**.
- Heat is the principal form in which we utilize energy, so mechanical engineering is fundamental to **processes in which energy is created and used**.
- Field of mechanics is divided into subfields of **solid mechanics and fluid mechanics**
- Mechanical engineers engage in: engine designs, machinery design, air conditioning systems, aerospace vehicles, turbines for power generators, automatic control etc.



NUCLEAR ENGINEERING

- Nuclear engineering is concerned with the **release, control, and use of all aspects of energy from nuclear sources.**
- It utilizes all of the conventional branches of engineering, with the connecting link of nuclear radiation running between them.
- The term nuclear engineering applies to the **design or operation of nuclear power plants.**
- In each nuclear plant there are nuclear engineers on the staff whose primary job it is to maintain technical surveillance over operation of the nuclear reactor core and the handling of the nuclear fuel.



PETROLEUM ENGINEERING

- Petroleum engineering is concerned with the **planning, development, and production of oil and gas fields**, including economic factors and optimal recovery.
- Petroleum engineers must possess knowledge of such things as the geology of reservoirs, characteristics of crude oil, flow of fluids through porous media, drilling techniques, estimation of reserves, probable recovery of total resources, and engineering economics.



SOFTWARE ENGINEERING

- Designing, implementing, and modifying **software** – of higher quality, more affordable, maintainable, and faster to build.

- Software requirements
- Software design
- Software development
- Software testing
- Software maintenance



Wikipedia : The [Airbus A380](#) uses a substantial amount of software to create a "paperless" cockpit



SYSTEMS ENGINEERING

- Systems engineering is an **interdisciplinary** field of engineering that focuses on how complex engineering projects should be designed and managed.
- Deals with issues such as
 - **logistics, coordination** of different teams, **automatic control** of machinery.
- Deals with **work-processes** and **tools** to handle such project
- Overlaps with both technical and human-centered disciplines such as **control** engineering, **industrial** engineering, **organizational** studies, and **project management**.

