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Professions in Science and Technology (MST)

Course Objective:

In the first stage, the objective is to introduce the student to all the fields covered by the domain of Science and Technology (especially mechanical engineering), and in the second stage, to provide an overview of the careers that arise from these disciplines. In the same context, this course also acquaints the student with the new challenges of sustainable development and the emerging professions that may result from them.

CHAPTER 01: What is Engineering Sciences?

Engineering Sciences, also known as Engineering Science, is a multidisciplinary field that applies scientific principles, mathematics, and engineering techniques to solve complex engineering problems. It serves as the foundation for various engineering disciplines and provides a broad understanding of the fundamental principles that underlie engineering applications. Here are some key aspects of Engineering Sciences:

- ✓ **Interdisciplinary Nature:** Engineering Sciences integrate concepts from various scientific and engineering disciplines, such as physics, chemistry, mathematics, biology, and materials science. It seeks to establish a strong theoretical and scientific foundation for engineering practice.
- ✓ **Core Concepts:** It encompasses a range of core concepts, including mechanics, thermodynamics, electromagnetism, materials science, fluid dynamics, and control theory. These concepts are essential for understanding the behavior of physical systems and designing solutions.
- ✓ **Problem Solving:** Engineering Sciences focus on problem-solving skills and analytical thinking. Engineers in this field analyze and model complex systems, conduct experiments, and use mathematical and computational tools to arrive at solutions.
- ✓ **Research and Innovation:** Research in Engineering Sciences often leads to innovative technologies and advancements in engineering fields. It contributes to the development of new materials, processes, and technologies that benefit society.
- ✓ **Education:** Engineering Sciences are taught at universities and engineering schools as part of undergraduate and graduate programs. Students study subjects like calculus, physics, chemistry, and engineering mathematics to build a strong foundation.
- ✓ **Bridge Between Science and Engineering:** Engineering Sciences serve as a bridge between pure scientific research and engineering applications. They help translate scientific discoveries into practical engineering solutions.
- ✓ **Diverse Applications:** The knowledge gained from Engineering Sciences can be applied to a wide range of engineering disciplines, including civil engineering, mechanical engineering, electrical engineering, aerospace engineering, and more.
- ✓ **Continual Advancement:** As scientific knowledge advances and technology evolves, Engineering Sciences continually adapt and incorporate new findings into engineering practice.

In summary, Engineering Sciences provide the theoretical framework and scientific understanding that underpin the practice of engineering across various disciplines. Engineers who have a solid grounding in Engineering Sciences are better equipped to tackle complex and novel engineering challenges.

1. Careers in Science and Technology

There are many careers in science and technology, such as:

- ✓ **Engineer:** There are different types of engineers, such as hydraulic engineers, mechanical engineers, electronic engineers, civil engineers, etc. Their role is to design, develop and test products, systems or services
- ✓ **Researcher:** Researchers can work in universities, research institutes or companies. They carry out scientific research in fields such as biology, physics, chemistry, computer science, etc.
- ✓ **Technician:** Technicians are professionals who apply scientific and technical knowledge to maintain and use laboratory equipment and instruments.
- ✓ **Data Analyst:** Data analysts collect, store, manage, analyze data and use statistical tools to extract useful information for businesses and organizations.
- ✓ **Teacher:** Teachers teach science and technology in schools and universities.

These are just a few examples, there are many other professions related to science and technology.

2. Search for a job !

I can't directly assist you in searching for a job, but I can offer some guidance on how to approach a job search:

1. **Identify Your Goals:** Determine the type of job you're looking for, including the industry, location, and your specific skills and qualifications.
2. **Prepare Your Resume/CV:** Update your resume or CV to reflect your most recent experiences and achievements. Tailor it to the specific job you're applying for.
3. **Use Online Job Boards:** Explore popular job search websites like Indeed, LinkedIn, Glassdoor, Monster, and CareerBuilder. These platforms allow you to search for jobs by keyword, location, and other filters.
4. **Company Websites:** Visit the career pages of companies you're interested in working for. Many employers post job openings directly on their websites.

5. **Networking:** Leverage your professional network. Inform friends, family, and colleagues about your job search, and consider using LinkedIn to connect with professionals in your field.
6. **Recruitment Agencies:** Some industries rely on recruitment agencies to fill job positions. You can reach out to these agencies that specialize in your field.
7. **Professional Associations:** If you're part of a professional association related to your field, they may have job boards or resources to help you in your search.
8. **Create an Online Presence:** Ensure your LinkedIn profile is complete and professional. It can serve as an online resume and networking tool.
9. **Set Up Job Alerts:** On job search websites, you can set up job alerts based on your criteria. This way, you'll receive notifications when new relevant positions are posted.
10. **Customize Your Applications:** Tailor your job applications for each position. Write a unique cover letter for each application and align your resume with the job requirements.
11. **Prepare for Interviews:** Once you start getting interview requests, be prepared. Research the company, practice answering common interview questions, and have questions ready to ask the interviewer.
12. **Stay Persistent:** Job searching can be a lengthy process, so don't get discouraged. Continue applying and networking while staying patient.

Remember that job searching can be a competitive process, so persistence and preparation are key. Be proactive in reaching out to potential employers and showcasing your skills and qualifications. Good luck with your job search!

CHAPTER 02: Electronics, Electrical Engineering, Communication Systems and New Sensor Technologies

1. Electronics

Preamble

Electronics has penetrated widely in our daily lives:

- laptops,
- equipment of our cars,
- computers,
- media players,
- household appliances...

What is electronics?

- ✓ Electronics is the science of controlling the **movement of electrons**.

- ✓ Electronics is a branch of **applied physics**, dealing, among other things, with the formatting and management of **electrical signals**, for example, for the transmission or reception of information. The adjective "electronic" also refers to what is related to the electron.

1.1. Materials and Current in Electronics

a. Conductors:

- Conductors are materials that allow the easy flow of electrical current.
- Examples of conductors (e.g., copper, aluminum, and silver).
- Their properties are low resistance and good conductivity.

b. Insulators:

- Insulators are materials that do not allow the flow of electrical current.
- Examples of insulators (e.g., rubber, glass, plastic).
- Their properties are high resistance and poor conductivity.

The excellent conductivity of copper and its alloys explains its large-scale use in the electronics industry. Copper allows electronic installations to operate faster, reduce heat formation and last longer: in short, have ever higher performance.

Electronics is the domain by excellence of "**low currents**" with a level of intensity of the order of the (ma).

1.2. Electronics professions:

The professional fields that represent the electronics professions are in the following areas:

- Audiovisual-multimedia equipment.
- Computer equipment.
- Professional audiovisual equipment.
- Housing comfort equipment (Electrodomestique).
- Household appliances.
- Alarm and security equipment.
- Telecommunications equipment and networks.
- Electronic equipment on board.
- Observation, analysis and measurement instrumentation equipment.

2. Electrical Engineering

What is Electrical Engineering?



- The discipline that studies the production, transportation, processing, transformation and use of electric energy.

We can note that, **electrical engineering** is associated with "**high currents**" as opposed to "**weak currents**" which would be the exclusive domain of **electronics**.

2.1. Application Fields

- a) It is extremely extensive and involves a very large number of industrial enterprises, in the areas of:
 - The production and transportation of electricity (thermal power plants, nuclear power, solar power, wind energy, electricity transmission networks, processing station...)
 - Manufacture of electrical equipment (electric engines, disconnectors, contactors, switches...)
- b) Electrical engineering is closely linked to the electronics and automation that it frequently uses, for the control of engines.

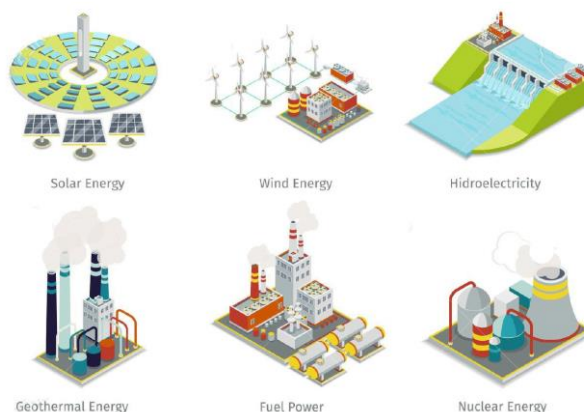


FIG 2 : The production of electricity

2.2. Electrical engineering professions

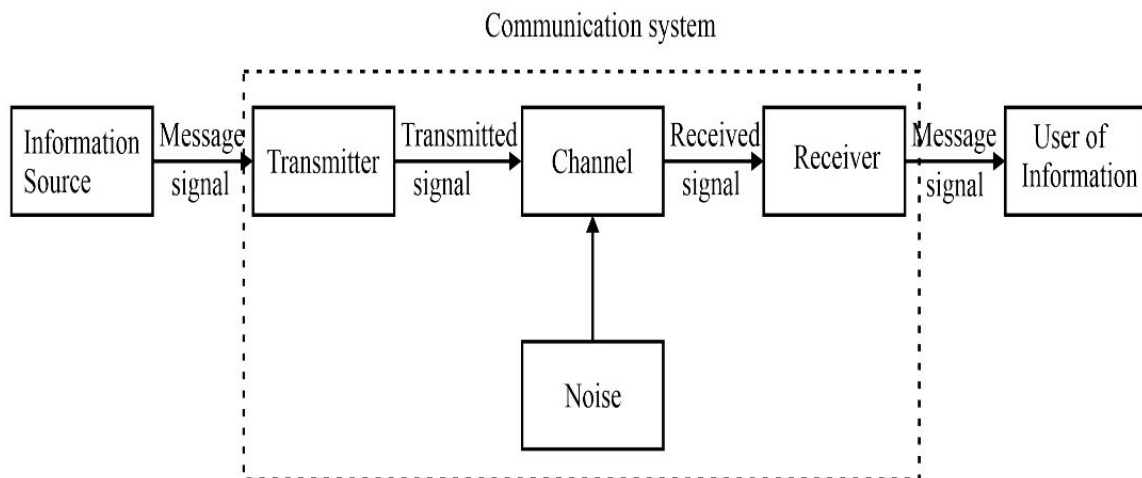
The professional fields which represent the electrical engineering professions are the following fields:

- Electrical machines (electric motors, generators, alternators, converters, etc.);
- Electrical voltage transformers;
- Electrical networks (Base Voltage, Medium Voltage, High Voltage);
- Storage (battery, capacitors);
- Electrical installations and safety equipment (meters, disconnectors, wire cutters, electrical cables, etc.).

3. Communication systems

The function of a communication system is to ensure the **transport of information** between a transmitter and one (or more) receiver(s) connected by a **communication channel** or communication medium. This information is transported in the form of a signal.

Examples of communication systems taken outside the Information technology (IT) field are: the telephone, television.



3.1. What is a communication protocol?

- A protocol is a standard specification that allows communication between two devices. These are rules and procedures that define the type of encoding and speed used during communication, as well as how to establish and terminate the connection.

- There are multitudes of communication protocols, such as VPN (Virtual Private Network) protocols which are designed to create a direct connection between remote computers.

3.2. Function of the communications system engineer

The communication systems engineer imagines, designs, develops, manages, and secures communication networks that facilitate the exchange of information in the form of signals, images, sounds, and films. Their field of activity is at the intersection of:

- Computer science, mathematics, and telecommunications. Their scope ranges from smart card to remote surgery, through mobile phones, laptops, servers, the Internet, the web and corporate networks, maintenance predictive...

3.3. Career prospects

- Companies or administrations that need to set up and manage a computer network (multinational companies, banks, hospitals),
- Telecommunications companies,
- Research and Teaching,
- Consulting Engineering Offices...etc