Electronics, Telecommunications, Engineering sectors Biomedical, Electrotechnical, Electromechanical, Optics & Precision Mechanics

2-1 Introduction:

The electronics and electro-technical sector plays a very important role in our daily lives. It has enabled the progression of many objects that have become essential (TV, Phones, MP players, GPS, etc.) and to all sectors of activity. This sector is thus positioned as a large consumer of labor.

2.2 What is electronic

Electronics is the science of controlling the movements of electrons.

Digital signal

The signal transmits information. Knowledge of the signal allows the interpretation of the measurement and understanding the operation of a circuit, devices, machines or others. Their classification facilitates this interpretation. The transition from one type of data to another will be done by converters, “mixed” components. which will manipulate analog voltages at the input and logic signals at the output or vice versa.

There are two categories of converters:

Analog to Digital Converters

(CAN, ADC in English, for analog to digital converter), which will transform analog voltages into logic signals; capable of being processed by microprocessor (digitization of signals).

Digital to Analog Converters

(DAC, DAC in English, for digital to analog converter) which will convert logic signals into analog voltage. Several types of converters are available in each category, which differ in their precision, their information processing speed, their price, etc. There is no "all-purpose" converter that is good everywhere: we will have to make a choice based on their needs.

2.3.1 Electronics professions

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

* Audiovisual-multimedia equipment.
* IT equipment. & Professional audiovisual equipment.
* Home comfort equipment (domestic appliances).
* Household appliances.
* Alarm and security equipment.
* Telecommunications equipment and networks.
* On-board electronic equipment.
* Observation, analysis, and measurement instrumentation equipment. Materials and current in electronics

* The excellent conductivity of copper and its alloys explains its widespread use scale in the electronics industry. Copper allows electronic installations to operate faster, reduce heat build-up, and last longer: few words to have ever higher performance.
* Electronics is the field par excellence of "low currents" whose level intensity is of the order of a mill ampere.

2.4 Fields of application:

a**) Home automation**

Home automation allows you to manage the energy sources in your home. Heating, air conditioning, lighting, opening and closing of blinds, water temperature, and filling, charging of battery-powered devices, etc. The home automation sector brings together many professions, whose profiles can come from various disciplines: IT, electrical engineering, electronics, or telecommunications (optical fiber, etc.). Jobs in the sector: home automation engineer, responsible for maintenance, customer support technician, IT security expert.

b) on-board system for automobiles:

An autonomous electronic and computer system dedicated to a specific task, often in real-time, having a limited size and having restricted energy consumption. For designing an embedded system, it is generally necessary to combine skills in electronics, industrial computing, and automation.

c) Video surveillance:

a system of cameras and image transmission, located in a public or private space to monitor it remotely; it is, therefore, a type of remote monitoring.

2**.4.1 Specialist role:**

The purpose of electronics is the processing by hardware components of the signal electrical and the distribution of electrical power. Signals are classified into two major types: analog signals; and digital signals.

2.5 What is electro technics:

Electrical engineering is the study of the technical applications of electricity, the discipline which studies the production, transport, treatment, transformation, and use of energy electric.

2.5.1 The Origin of Electrical Energy:

Electrical energy is secondary energy that is produced from primary energies contained in
* Uranium (fission energy exploited in nuclear power plants),
* Water (potential energy in hydroelectric dams),
*Coal and oil (combustion energy),
* The wind (kinetic energy of the air transformed by wind turbines), The sun (solar radiation transformed by photovoltaic cells or by power plants with reflecting mirrors).

In almost all cases, primary energy is transformed, in power plants, into mechanical energy using turbines. The turbines are directly coupled to alternators which produce energy electrical in the form of three-phase voltages of constant frequency and amplitude.

2.5.2 Electrical Engineering Professions

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

* Electrical machines (electric motors, generators, alternators, converters, etc.),
* Electrical voltage transformers,
*Electrical networks (BT, MT, HT)
* Storage (battery, capacitors)
* Electrical installation and safety equipment (meters, circuit breakers, disconnections, electrical cables, etc.)

2.5.3 Fields of application:

a) **Electricity production**

Electric energy is produced in power stations. Electricity flows from the place where it is manufactured to the place where it is consumed, via a network of overhead or underground power lines. It allows energy to be transported and distributed electricity throughout Algeria.

b) **Hydraulic central** A hydraulic power plant produces electricity thanks to a waterfall between two levels of different heights, which sets in motion a turbine connected to an alternator according to the next steps.

c). **Energy efficiency**

The energy efficiency of a system is the energy ratio between the quantity of energy delivered and the quantity of energy absorbed. There is less loss and better energy efficiency, energy efficiency is thus linked to maximizing yield. Increasing energy efficiency thus makes it possible to reduce energy consumption, for the same service provided. This results in a reduction in ecological, economic, and social costs linked to energy production and consumption.

2.5.4 role of specialist in electrical engineering

The specialist in electricity applications: he designs, analyzes, installs, and takes care of maintenance of domestic or industrial electrical equipment (automated programmable factory) or office.

2.6 Electro mechanics

Refers to a mechanical command or control device, in conjunction with organs electrical. Application of electricity to mechanics. Today, equipment based on electro mechanics is so numerous that it is impossible to list them all. What is very likely is that you use it on a daily basis, both in your private life and in your professional life. Here are some examples:

* Household appliances such as dishwashers, refrigerators or vacuum cleaners,
* The transport sector, such as trains and trams,
* The automobile industry, particularly with alternators and other electric motors,
* CD players, printers, DVD players, etc.,
* Motors and other hydraulic presses,

2.6.1 The profession of electromechanical

The job of electromechanical is particularly technical and you must have the skills necessary for the assembly and dismantling of equipment, in order to respect the manufacturers' specifications. With advances in automation technology and machine learning, jobs once done by humans are now occupied by machines. However, it still requires a person with mechanical knowledge to install and maintain these machines, in particular, to prevent a breakdown Many products, formerly purely mechanical, now use mechatronics to operate, including various automotive

systems such as anti-lock brakes, as well as household items like DSLR cameras. These types of systems represent the future of the electromechanical field

2.6.2 Fields of application:

Industrial maintenance:

Industrial maintenance can be defined as maintaining or restoring production equipment to a state defined in advance so that it is able to provide service.

b. Elevator: An elevator is a vertical transport device ensuring movement in height.

c. Wind turbine: A wind turbine is a device that transforms the kinetic energy of the wind into mechanical energy, called wind energy, which is then most often.

d. Mechatronics

Mechatronics is a field that combines mechanics, electrical, automation, and computer science. It is often considered the combination of skills that will be needed to lead advanced automated manufacturing in the future.

People who work at the intersection of these disciplines may also have extensive knowledge in robotics, electronics, and telecommunications. They are responsible for creating simpler, yet more powerful and intelligent systems.

2.6.3 Role of electromechanical specialist:

The electromechanics specialist who ensures the proper functioning of the electromechanical equipment ensures its maintenance in the event of a malfunction.

2.7 Telecommunications

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 medium. This information is transported in the form of a signal.

2.7.1 Definition

Telecommunications (fam. telecoms) is not considered as a science but as applied technologies and technique. Telecommunications means any remote transmission, emission, and reception of signs, signals, writings, images, sounds or information of all kinds, by electric wire, radio electricity, optics, or other electromagnetic systems (definition of OFTEL, today Ofcom).

2.7.2 Principles of Telecommunications Technology

A telecommunications link has three main elements:

ν A transmitter that takes information and converts it into an electrical, optical, or radio.

ν A transmission line, optical fiber, or radio space, connects the transmitter and receiver.

ν A receiver that receives the signal and converts it into usable information.

2.7.3 Fields of application:

has. Mobile telephony is based on radiotelephony, that is to say, the transmission of voice using radio waves (frequencies in the 900 and 1800 MHz band) between a relay base that covers an area of several tens of kilometers in radius and the user's mobile phone.

b. The radio

Radio can be defined as any communication via radio space. It is, therefore, a varied field, including radio broadcasting of programs, services of radiotelephony, point-to-point or network communications, radio entertainment such as amateur radio, and connections with telecommunications satellite or radio beam.

c **Internet**,

Although the Internet is not the only computer networking system, it has almost become synonymous with it. The structure of the internet is complex and can be divided into:

* A physical communication system (subscriber lines, modems, routers that connect to the web)
* A transport system between users (protocols, servers, etc.).
* An application system that provides the final service (messaging, image, voice, search engine, etc.).

d. The radar

Although radar is not strictly speaking a communication system, but remote sensing, its techniques combine microwave radio, signal processing, and radio electricity, and can be linked to the world of telecommunications. Initially developed for the detection of air raids, radar was very quickly installed on ships, and then planes. First military and then civil, air, and maritime control use radar intensively for security. Finally, meteorological radar makes it possible to map rain and clouds, including from observation satellites.

e. Navigation

Radio navigation has made it possible, since the beginnings of radio, to help with maritime and then air navigation, thanks to radio direction finding and radio beacons, then hyperbolic systems. Today, satellite navigation systems such as GPS have become common equipment in vehicles, while awaiting the development of the future Galileo, automatic identification systems such as AIS and obstacle detection improve vehicle safety. and navigation.

f. Military applications

In addition to telecommunications itself, which uses methods of discretion such as frequency evasion and encryption, governments use radio techniques for the purpose of signals intelligence, such as the echelon system. satellite listening, or jamming and countermeasures systems.

2.7.4 role of telecommunications specialist:

The communication specialist imagines, designs, develops, manages, and secures communication networks promoting the exchange of information in the form of signals, images, sounds, and films. Their field of activity is located at the crossroads of: IT, mathematics and telecommunications. As well as how to establish and complete the connection.

2.8 Instrumentation and Microsystems

2.8.1 Instrumentation Etymologically, Instrument comes from the Latin “instrument”: “to arrange, to equip”, which gave “to instruct”. “Instrumental” is the material, the tools. As for “tool”, its etymological meaning is close since it comes from “utensils”: “necessary for our needs”. The scientific instrument can have several functions: ν Measure, and introduce a defined, repetitive quantity, identical to itself, which can be manipulated, compared, and counted; ν Increase the power of our forces (screw, lever, pulley, winch), increase the range of our senses (glasses, telescope, microscope) allowing us to discover undetectable phenomena otherwise; ν Allow experimentation. To verify a hypothesis or demonstrate a theory, acquisition of knowledge or transmission of knowledge: it is very difficult to say which type of experience preceded the other.

2.8.2 Fields of application:

Medical instrument:

The term "medical device" is used to refer to a wide range of products used for the treatment, mitigation, diagnosis, or prevention of a disease or condition abnormal physique.

The different types of medical devices are:

There are different types of medical devices: non-implantable (hearing aids, wheelchairs, glasses, dressings), or implantable (hip prostheses, stimulators). cardiac implants, dental implants), sometimes custom-made (orthopedic insoles, dental implants).

2.9 Microsystems

A microsystem is an electronic chip containing parts, not electronics, such as a sensor or an actuator. A microsystem can contain a temperature sensor, analog electronics for converting the values of the sensor, and digital electronics for interfacing with other chips, all integrated into a single electronic component.

2.9.1 Fields of application:

A captor

A sensor is a device that generates an electrical signal when subjected to the action of a quantity (object of measurement) called measured, the nature of which can be physical, chemical, or biological.

a.1 Sensor principle

A sensor is an organ for collecting information that develops from a physical quantity (Incoming Information) to another physical quantity of a different nature (Outgoing information: very often electrical).

This greatness, representative of the greatness taken, can be used for measurement or control purposes Physical quantity _____ Detector_____ Physical quantity (Presence, electrical, optical, Position, Linear displacement, Level, Speed, Acceleration, Force, Pressure...). We distinguish

1. Passive sensors

They require an electrical energy supply.

2. Active sensors

They use part of the energy provided by the physical quantity to be measured.

a.2 The different types of sensors:

In the vast majority of cases, the signals coming from a sensor will be electrical, which means that they can be voltages or currents. There can be three different types of output signals:

* Binary signal * Analog signal, * Digital signal.

b. Actuator:

An actuator is a mechanical device that translates an external request into a physical action (e.g. force or movement, pump, valve, etc.).

2.10 Optics:

Optics is the branch of physics that deals with light, its behavior, and its properties, from electromagnetic radiation to vision through systems using or emitting light.

2.10.1 Fields of application:

A. Optical fiber

Is a very fine glass or plastic wire that has the property of conducting light and is used in terrestrial and oceanic data transmissions. It offers a flow of information significantly superior to that of coaxial cables and supports a “wide” network can transmit television, telephone, videoconferencing or data computers.

B. Giant mirror:

Due to a lack of sufficient light, residents installed mirrors at the top of the mountain. The inhabitants of Rjukan will have light in winter. They installed mirror giants at the top of the mountain to capture the light. The mirror is a decorative element with many virtues and, one of the most important is, without doubt, the reflection it sends back. He is in particularly useful effect for visually enlarging a room and giving depth to this one.

2.10.2 What are the Optics professions

* The optician-eyeglass maker.
* The precision optician.
* The optics and eyewear fitter.
* The industrial optics engineer.
* The senior technician in instrumental optics.
* The senior technician specializing in photonics.

2.10.3 Contact lenses: (Ophthalmology)

The flexible and circular membrane that is placed on the eye to correct vision or change the appearance of the eye.

2.10.4 role of Optics Specialist

The optician specialist:

* Designs and develops the production of instruments for instrumental optics and photonics in sectors such as aeronautics or telecommunications.
* The design and control of complex optical systems such as devices for astronomy or camera lenses.

2.11 Precision Mechanics

Precision mechanics brings together the activities of manufacturing parts that have low tolerances.

2.11.1 What is precision mechanics?

By precision mechanics, we mean the manufacture of mechanical parts that do not allow any defects to pass. The use of these parts has the same name. As small as he may be, parts manufactured by precision mechanics do not tolerate any errors. There exist several companies that specialize in this sector. You should know that these parts must be impeccable because they are often used in areas that require precision infallible:

* Surgery. * Watchmaking. * Aeronautics. * Armament, etc.

The pieces have very complicated profiles due to their small size. Sometimes particular metal alloys are used to make these parts. The components of these parts must be manufactured with the greatest care. Also, once these products are made, they are subjected to numerous tests and meticulous checks to verify the quality of the part. It is above all in this idea that this sector differentiates itself from that of mechanics. industrial.

2.11.2 Specialty role in precision mechanics

Precision mechanics brings together the activities of manufacturing parts that have low tolerances.

2.12 Biomedical engineering

Biomedical engineering (GBM) is an application of engineering principles and techniques in the medical field aimed at the control of biological systems or the development of devices used for the diagnosis and treatment of patients. This area is a blend of medicine, biology, engineering, and physics.

2.12.1 Biomedical engineering, what is it?

The biomedical engineering engineer works in the medical environment or in companies manufacturing biomedical devices. It designs and manages medical applications for the diagnosis, treatment, or monitoring of patients, with a view to improving the quality of patient care. He listens to the healthcare staff and their needs and constraints, but also to those of managers and decision-makers.

2.12.2 the Biomedical Engineer profession:

Radiography. Based on the use of X-rays, mainly makes it possible to obtain two-dimensional images of bones and joints, but also of the lungs and breast (mammography).

* CT, MRI, and nuclear medicine.

2.12.3 The role of specialty in biomedical engineering

The biomedical engineer works with doctors, nurses, therapists, and technicians in areas such as:

* cellular engineering, tissue engineering, genetic engineering, approach to disease at the microscopic level biomaterials, biomechanics, orthopedic engineering, development of devices such as pacemakers, prosthetic arthroplasty, artificial kidneys, etc.
* neurology, research-oriented towards psychological disorders
* clinical engineering, improvement in the design of medical equipment. The biomedical engineer designs and develops various technological products for the medicine and health sector. Its work thus affects a multitude of devices and calls on various technologies, such as medical imaging, diagnostic equipment, intelligent body probes, operating robots, cardiac pacemakers, rehabilitation or even orthotics-prosthetics. But the complexity of biomedical engineering does not only lie in the cutting-edge technology used in the field; it is also about being able to join two very complex and different fields: medicine and engineering. A biomedical engineer must therefore master the notions of computer science, artificial intelligence, and 3D imaging. mechanics and the biology of the human body.