Unit 6 «APPLICATION OF ELECTRONICS»

PAGE 78-89 WORKING
WITH NEW
TECHNOLOGY

WHAT IS ELECTRONICS?

ELECTRONICS IS THE SCIENCE THAT CONTROLS THE FLOW OF ELECTRICITY TO ACHIEVE A SPECIFIC PURPOSE. THE MOST COMMON PURPOSE IS TO MAKE A DEVICE WORK (COMPUTER, HOUSEHOLD APPLIANCES, ELECTRIC DEVICES AND TOYS…)
IT IS BASED ON THE STATEMENT THAT ELECTRICITY CAN CARRY SIGNALS THROUGH THE CHANGES OF THE CURRENT; SIGNALS MAY THEN REPRESENT LETTERS, NUMBERS, SIGNS OR SOUNDS.

THE CURRENT, BY PASSING THROUGH THE CIRCUIT' COMPONENTS, IS MODIFIED.

"Electronics", as the name implies **relating to electrons.** The word electronics arrived from electron mechanics (Behaviour of the electron when it is subjected to externally applied fields).
The *definition of electronics* technically says "Electronics is an engineering branch that concerns with the flow of current through semiconductor, gas or any form of matter.

WHERE IS ELECTRONICS APPLIED?

1) Common use:

Office Gadgets such as calculators, Personal computers, Scanners and Printers, FAX machine, Front Projector etc.
-Home appliances such as Washing Machine, Refrigerator, Air Conditioner, Microwave Oven, Vacuum Cleaner etc.
-Audio and Video Systems such as Headphone, VCRs, DVD players, Color TVs, Microphone and Loudspeaker, Video game consoles.
-Advanced Consumer Devices such as Setup Box, ATM, Dishwasher, Smart Phones, PDA (*personal digital assistant*), Barcode Scanners, POS terminals.
-Storage Devices for optical playback and taping, and portable infotainment. Examples are DVDs, HDD jukebox, Portable MP3 player.

2) Industrial automation

3) **Smart grid systems**

Smart electric systems collect information from the communication technology and react accordingly based on power consumption. It is an application of intelligence, computing, and networked electricity systems
-**Digital system based on two-way communication**
-Interactive Sensors
-Self-monitoring and Debugging
-Valid Distribution of electricity

4) **Image processing**

5) Medical application

-***Stethoscope*** to listen inner sounds happening inside the human or animal body

-***Respiration Monitors*** for knowing the patient condition due to change in body temperature, pulse, respiration and blood flow.

-***Defibrillator*** causes electrical shock to heart muscles and brings backs the heart to the normal working condition.

-***Glucose*** *meter* for measuring sugar levels in the blood.

-***Pace Maker*** for reducing and increasing the count of the heart beat.

6) Automotive:

-**Anti-collision unit**

-Infotainment console

-Anti-lock braking system

-Cruise control

-Traction control

-Window regulators

-Electronic Control Unit (ECU)

-Airbag control

7) **Defense and aeronautical applications:**

-Missile Launching systems
-Rocket Launchers for space
-Aircraft systems
-Cockpit controllers
-Military Radars
-Boom barrier for military applications

SEMICONDUCTORS: WHAT ARE THEY?

- **What is a semiconductor?**
- A semiconductor is a substance that has specific electrical properties that enable it to serve as a foundation for computers and other electronic devices. It is typically a solid chemical element or compound that conducts electricity under certain conditions but not others. This makes it an ideal medium to control electrical current and everyday electrical appliances.
- A substance that can conduct electricity is called the conductor and a substance that cannot conduct electricity is known as the insulator. Semiconductors have properties that sit between the conductor and insulator. A diode, integrated circuit (IC) and transistor are all made from semiconductors.
- The conductance can vary depending on the current or voltage applied to a control electrode or on the intensity of irradiation by infrared (IR), visible light, ultraviolet or X-rays. The specific properties of a semiconductor depend on the impurities -- known as dopants -- added to it.

- **How do semiconductors work?**
- Most semiconductors are composed of crystals made of several materials. To better understand how semiconductors work, users must understand atoms and how electrons organize themselves within the atom. Electrons arrange themselves in layers called shells inside an atom. The outermost shell in the atom is known as a valence shell.
- The electrons in this valence shell are the ones that form bonds with neighboring atoms. Such bonds are called covalent bonds. Most conductors have just one electron in the valence shell. Semiconductors, on the other hand, typically have four electrons in their valence shell.
- However, if atoms nearby are made of the same valence, electrons may bind with the valence electrons of other atoms. Whenever that happens, atoms organize themselves into crystal structures. We make most semiconductors with such crystals, mainly with silicon crystals.

- **What is the difference between N-type and P-type semiconductors?**
- An N-type semiconductor carries current mainly in the form of negatively charged electrons similar to the conduction of current in a wire. A P-type semiconductor carries current predominantly as electron deficiencies called holes. A hole has a positive electric charge, equal and opposite to the charge on an electron. In a semiconductor material, the flow of holes occurs in a direction opposite to the flow of electrons.
- Elemental semiconductors include antimony, arsenic, boron, carbon, germanium, selenium, silicon, sulfur and tellurium. Silicon is the best known of these, forming the basis of most ICs.
- Common semiconductor compounds include gallium arsenide, indium antimonide and the oxides of most metals. We also widely use gallium arsenide (GaAs) in low-noise, high-gain, weak-signal amplifying devices.
- A semiconductor device can perform the function of the original vacuum tube, but with hundreds of times its volume. Like a microprocessor chip, a single IC can do the work of a set of vacuum tubes that would fill a large building and require its own electricity generating plant.

THE TRANSISTOR:

- **Transistor:** Transistors are the active components of integrated circuits, or "microchips," which often contain billions of these minuscule devices etched into their shiny surfaces. Deeply embedded in almost everything electronic, transistors have become the nerve cells of the Information Age.
- There are typically three electrical leads in a transistor, called the emitter, the collector, and the base—or, in modern switching applications, the source, the drain, and the gate. An electrical signal applied to the base (or gate) influences the semiconductor material's ability to conduct electrical current, which flows between the emitter (or source) and collector (or drain) in most applications. A voltage source such as a battery drives the current, while the rate of current flow through the transistor at any given moment is governed by an input signal at the gate—much as a faucet valve is used to regulate the flow of water through a garden hose.

- The first commercial applications for transistors were for hearing aids and “pocket” radios during the 1950s. With their small size and low power consumption, transistors were desirable substitutes for the vacuum tubes (known as “valves” in Great Britain) then used to amplify weak electrical signals and produce audible sounds. Transistors also began to replace vacuum tubes in the oscillator circuits used to generate radio signals, especially after specialized structures were developed to handle the higher frequencies and power levels involved. Low-frequency, high-power applications, such as power-supply inverters that convert alternating current (AC) into direct current (DC), have also been transistorized. Some power transistors can now handle currents of hundreds of amperes at electric potentials over a thousand volts.

THE SILICON VALLEY

- The name Silicon Valley has become in the last years a way to call the US technological industry; Silicon valley is instead a place: it’s in California, near San Francisco. It has become the most important centre for electronic and informatic business.
- It all began in 1951 when the Stanford University set up a campus and an idustrial park, attracting industries such as IBM and Nasa. Then in 1956 the Shockley Transistor Corporation was founded near Palo Alto and in few years hundreds of companies came out competing one another.
- The USA government invested money in new technology, especially after the Sputnik launch in 1957 (From URSS) and this led to the modern age of computer and Internet.

TODAY:

- Silicon Valley is today the home of industries such as
- APPLE
- GOOGLE
- FACEBOOK
- EBAY
- HEWLETT-PACKARD
- CISCO
- INTEL
- NETFLIX
- SYMANTECH
- YAHOO
- YOUTUBE