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Fundamentals of Electronics I	المادة باللغة الانجليزية
أسس الإلكترونيك ١	المادة باللغة العربية
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Electronic Devices and Circuit Theory 11 <sup>th</sup> Edition by Robert L. Boylestad, Louis Nashelsky	المصادر والمراجع
Electronic Devices 9th Edition by Thomas L. Floyd	

# Electronic Fundamentals I

## Circuits, Devices, and Applications

### Lecture 0: Introduction

#### What is Electronics?

**Electronics**, branch of **physics** and **electrical engineering** that deals with the **emission, behavior, and effects** of **electrons** and with **electronic devices**.

The **science** and **technology** of the **conduction** of **electricity** in a **vacuum**, a **gas**, or a **semiconductor**, and **devices** based on them.



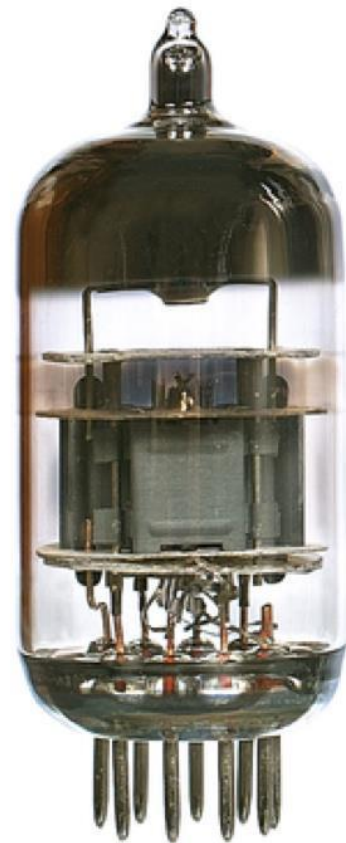
The modern discipline of electronic engineering was to a large extent born out of **telephone, radio, and television-equipment development** and the large amount of **electronic-systems development** during **World War II** of **radar, sonar, communication systems, and advanced ammunition and weapon systems**.



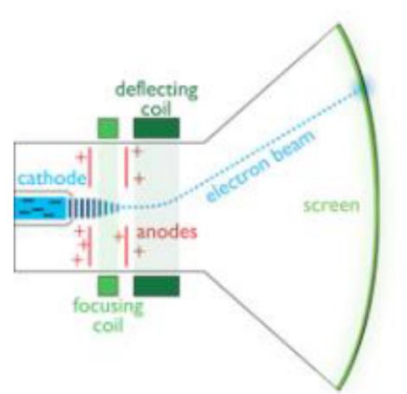
نشأ التخصص الحديث في الهندسة الإلكترونية إلى حد كبير من تطوير معدات الهاتف والراديو والتلفزيون والكمية الكبيرة من تطوير الأنظمة الإلكترونية خلال الحرب العالمية الثانية من الرادار والسونار وأنظمة الاتصالات وأنظمة الذخيرة والأسلحة المتقدمة.

## History of Electronics

- The history of electronics is a story of the twentieth century and three key components—the **vacuum tube**, the **transistor**, and the **integrated circuit**.
- In 1883, **Thomas Edison** discovered that electrons will flow from one metal conductor to another through a **vacuum**. This discovery of conduction became known as the **Edison effect**.
- In 1904, **John Fleming** applied the Edison effect in inventing a two-element **electron tube** called a **diode**. These **vacuum tubes** were the devices that made manipulation of electrical **energy** possible so it could be amplified and transmitted.
- The first applications of electron tubes were in **radio communications**. **Marconi** pioneered the development of the **wireless telegraph in 1896** and long-distance radio communication in 1901.
- In 1918, **Edwin Armstrong** invented the "super-heterodyne receiver" that could select among radio signals or stations and could receive distant signals.
- Radio broadcasting grew astronomically in the 1920s as a direct result. **Armstrong** also invented wide-band **frequency modulation (FM) in 1935**; only (AM) or amplitude modulation had been used from 1920 to 1935.



- Communications technology was able to make huge advances before World War II as more specialized tubes were made for many applications. Radio as the primary form of education and entertainment was so on challenged by **television**, which was invented in the 1920s but didn't become widely available until 1947.

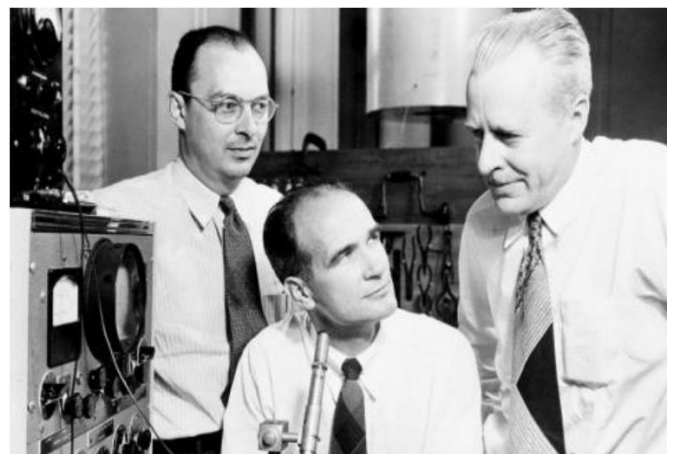


- When an electronic system was proved superior, **Bell Labs engineers introduced the cathode ray picture tube and color television.** But **Vladimir Zworykin**, an engineer with the Radio Corporation of America (RCA), is considered the "father of the television" because of his inventions, the **picture tube** and the **iconoscope camera tube**



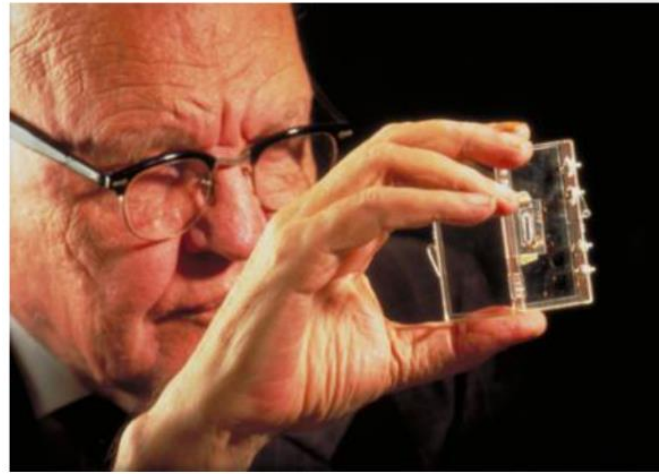
Vladimir Zworykin

- **After the war**, electron **tubes** were used to develop the **first computers**, but they were impractical because of the sizes of the electronic components.
- **In 1947, the transistor was invented by a team of engineers from Bell Laboratories. John Bardeen, Walter Brattain, and William Shockley** received a Nobel prize for their creation, but few could envision how quickly and dramatically the transistor would change the world.
- **The transistor functions like the vacuum tube, but it is tiny by comparison, weighs less, consumes less power,** is much more reliable, and is cheaper to manufacture.



John Bardeen, Walter Brattain, and William Shockley

- The concept of the **integrated circuit** was proposed in 1952 by **Geoffrey W.A. Dummer**, a British electronics expert with the Royal Radar Establishment.
- **Integrated circuit** combined **transistors and diodes (active devices) and capacitors and resistors (passive devices) on a planar unit or chip.**
- **Bipolar transistors** and **digital integrated circuits** were made first, but analog ICs, large-scale integration (LSI), and very-large-scale integration (VLSI) followed by the mid-1970s.
- **VLSI** consists of thousands of circuits with on-and-off switches or gates between them on a single chip. Microcomputers, medical equipment, video cameras, and communication satellites are only examples of devices made possible by integrated circuits.



**Geoffrey W. A. Dummer**



## Electronic Course Objectives



- **To understand** the basic physical structure, principles of operation, electrical characteristics and circuit models of the most important **semiconductor devices**, and to be able to use this knowledge to analyze and design basic electronic application circuits.
- **To extend the understanding** of how electronic circuits and their functions fit into larger electronic systems

## Electronic Course Description



- Semiconductor devices,
- electronic circuits,
- electrical characteristics,
- principles of operation,
- circuit models of diodes,
- field-effect and bipolar transistors,
- analysis and design of basic application circuits.

# Electronic Course Outline

## Unit 1

### Semiconductor Diodes

- Semiconductor materials,
- Energy Levels,
- n-type and p-type extrinsic materials,
- Semiconductor diode,
- Resistance level,
- Diode Equivalent Circuit.

## Unit 2

### Diode Applications

- Load Line analysis,
- Diode Approximation,
- Series Diode Configurations with DC input,
- parallel and series-parallel configuration,
- Sinusoidal input: half wave rectification,
- Full Wave Rectification with filter

## Unit 3

### Bipolar Junction Transistors (BJT)

- Transistor construction,
- transistor operation,
- Common-base configuration,
- Transistor amplifying action,
- Common-Emitter configuration,
- limits of operation.

## Unit 4

### DC Biasing of BJTs

- Operating Point,
- Fixed Bias Circuit,
- Emitter Stabilizer Bias Circuit,
- Voltage Divider Circuit,
- Voltage Divider Bias,
- Design Operation,
- Transistor Switching Networks.

## Unit 5

### Field-Effect Transistors (FET)

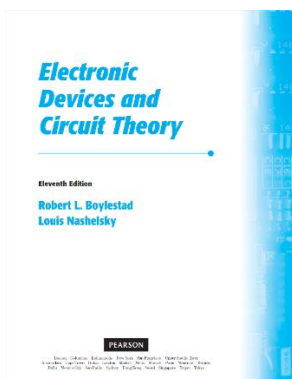
- Construction and Characteristics of JFET,
- Depletion-Type MOSFET,
- Enhancement-Type MOSFET.

## Unit 6

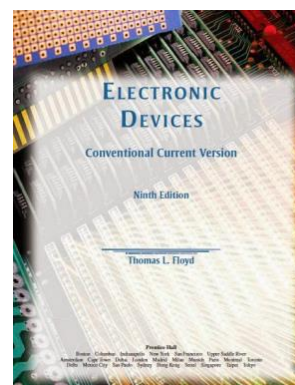
### BJT Modeling

- BJT Transistor Modeling,
- the Important Parameters:  $Z_{ii}$ ,  $Z_o$ ,  $A_v$ ,  $A_i$ , the  $r_e$
- Transistor Model

## Textbooks



**Electronic Devices and Circuit Theory**  
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