Basic Electronics

Lecture – 1: Introduction Class

Course outline

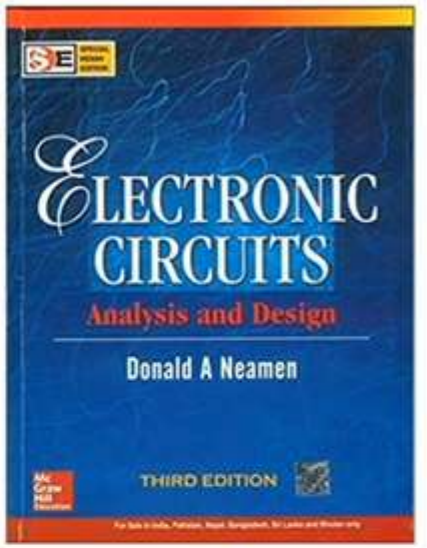
Major topics to be covered in this course:

1. Semiconductors and p-n junction diodes
2. Diode circuits
3. Filters (passive filters)
4. Bipolar Junction Transistor (BJT)
5. Basic BJT amplifiers
6. Field Effect Transistors (primarily MOSFETs)
7. Basic MOSFET amplifiers
8. Operational Amplifier (Op-Amp) and Op-Amp circuits
9. Digital Electronics (Boolean algebra, K-map, combinational and sequential circuits,...)
10. Oscillators*

* if time permits

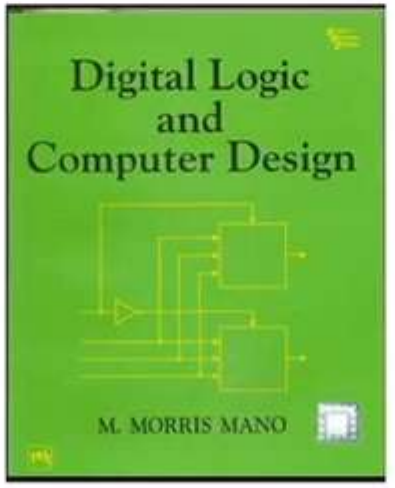
Books

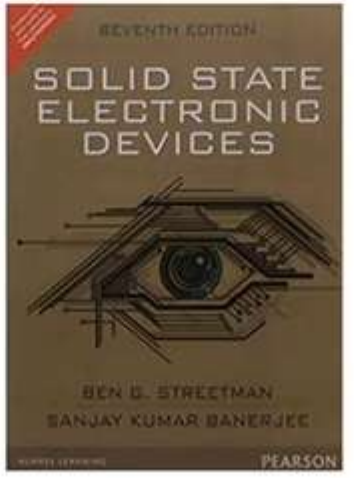
1. Electronic Circuits Analysis and Design – Donald A Neamen
2. Integrated Electronics – Jacob Millman and Christos Halkias
3. Digital Logic and Computer Design – M. Morris Mano
4. Solid State Electronic Devices – Ben. G. Streetman and S. Banerjee
5. The art of electronics – P. Horowitz and W. Hill



Text Book

Reference Books





What is Electronics??

Electronics: "The branch of physics and technology concerned with the design of circuits using transistors and microchips, and with the behavior and movement of **electrons** in a semiconductor, conductor, vacuum, or gas."*

"**Electronics** comprises the physics, engineering, technology and applications that deal with the emission, flow and control of electrons in vacuum and matter."**

Branches of electronics:

1. Digital Electronics
2. Microelectronics
3. Power Electronics
4. Optoelectronics → LED,
5. Telecommunications
6. Analog Electronics
7. Nanoelectronics etc...

*en.oxforddictionaries.com **wikipedia.org

Electronic circuits

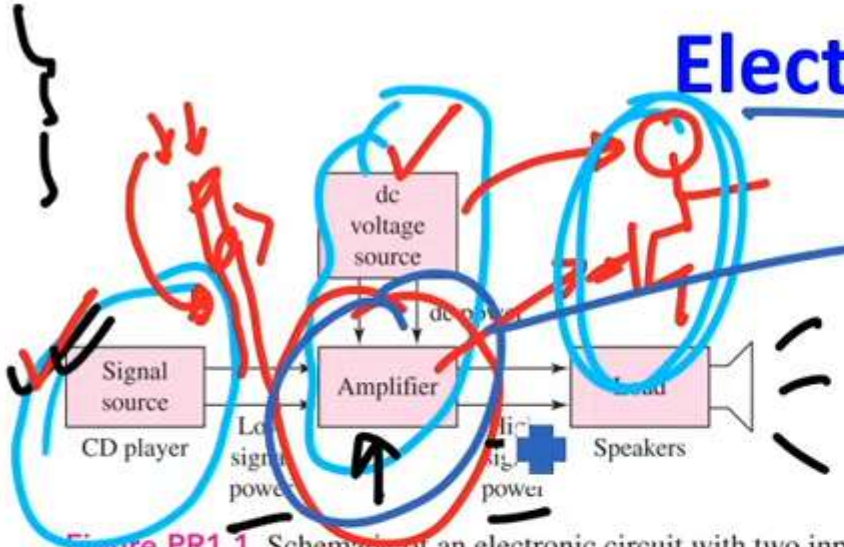
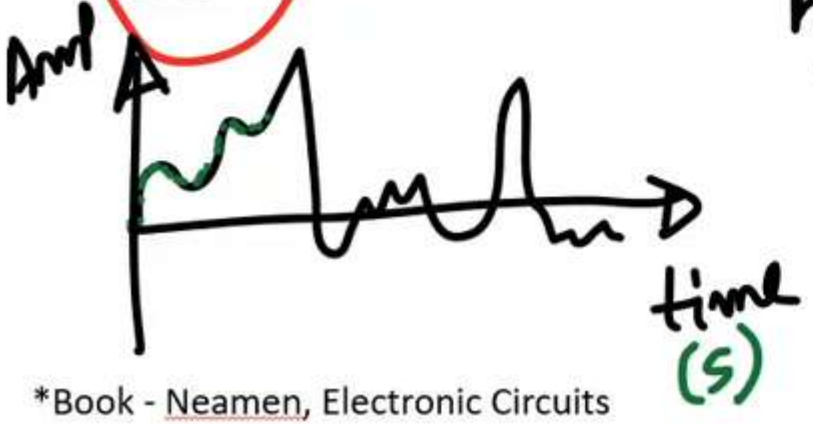
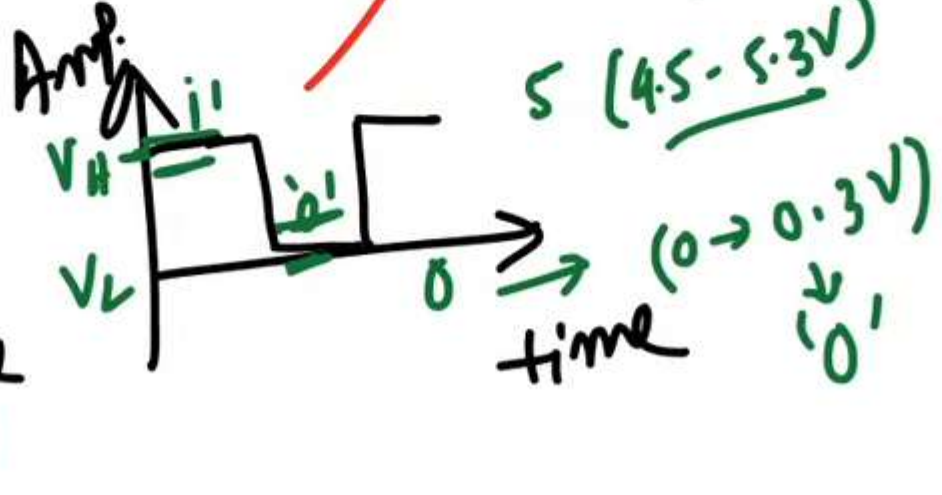
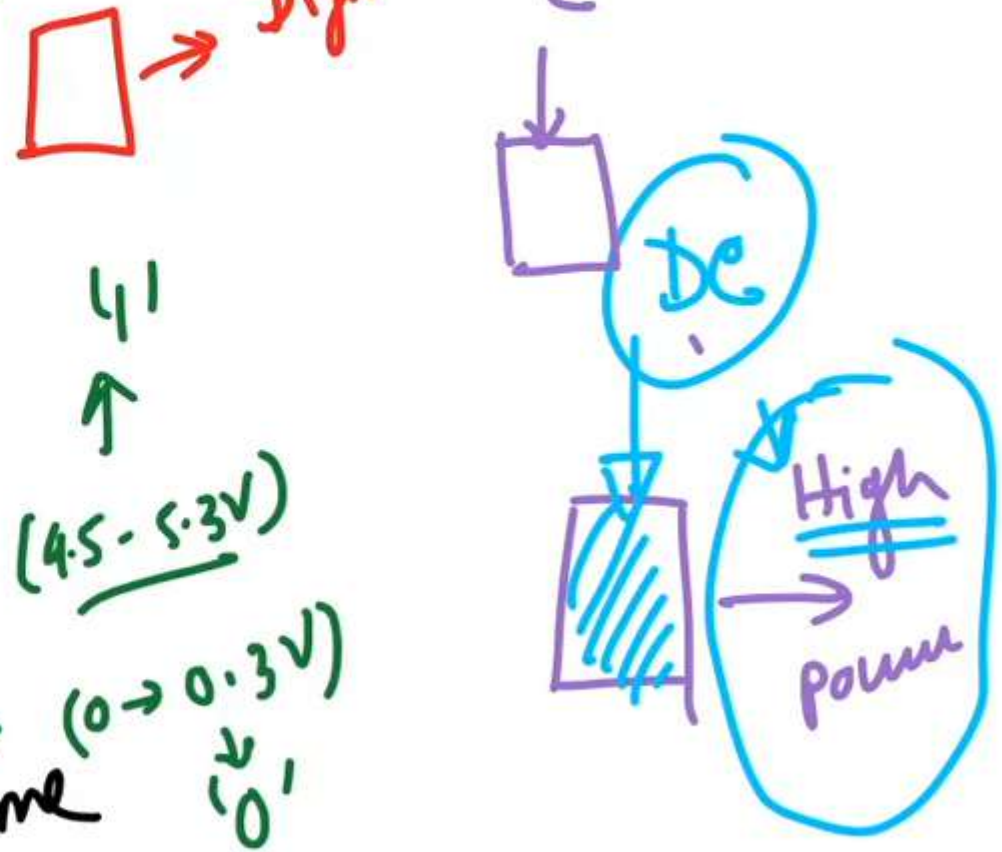


Figure PR1.1 Schematic of an electronic circuit with two input signals: the dc power supply input, and the signal input

Analog and Digital circuits







*Book - Neamen, Electronic Circuits

Electronic components

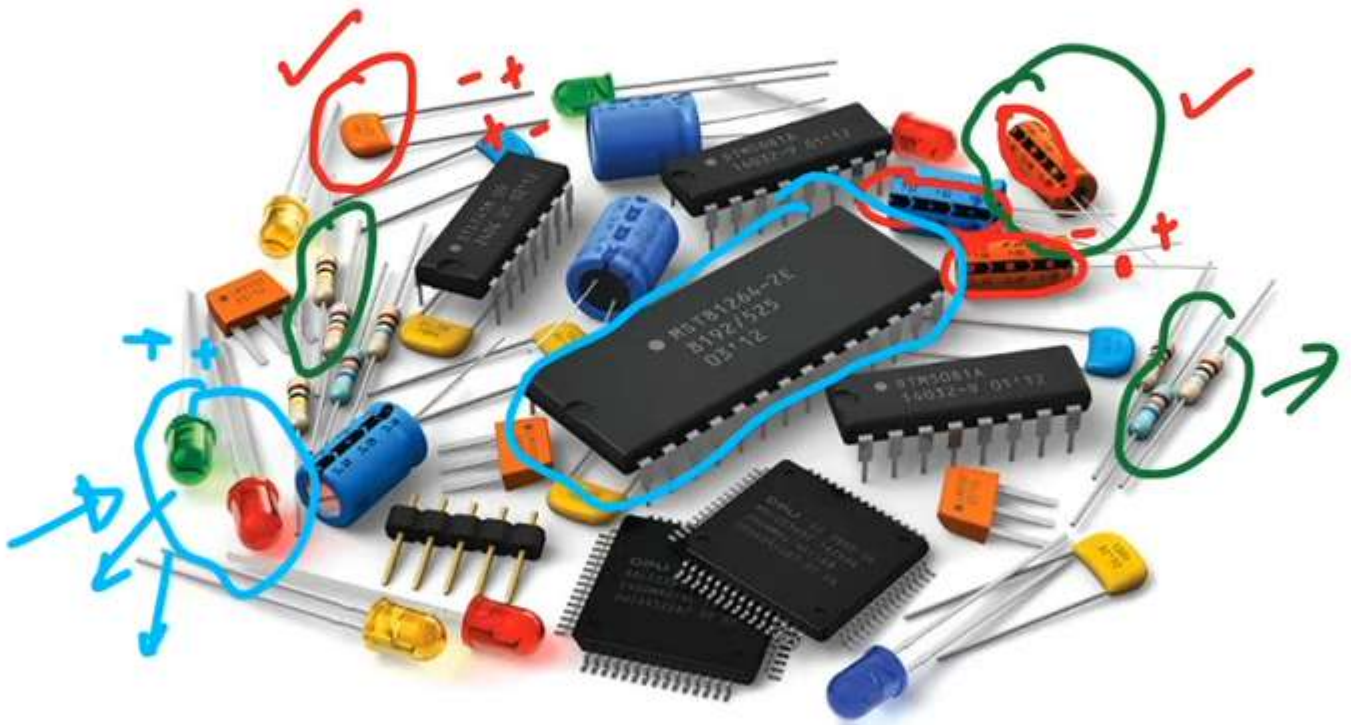
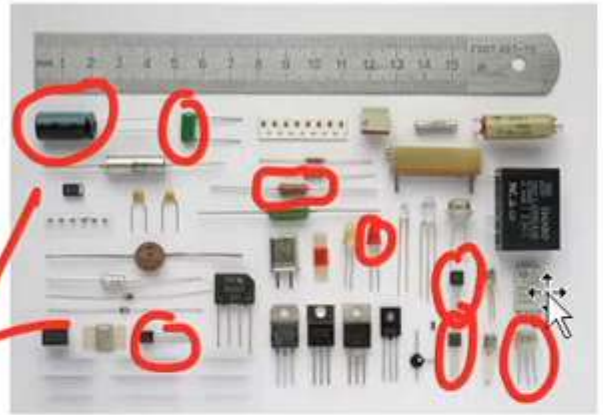
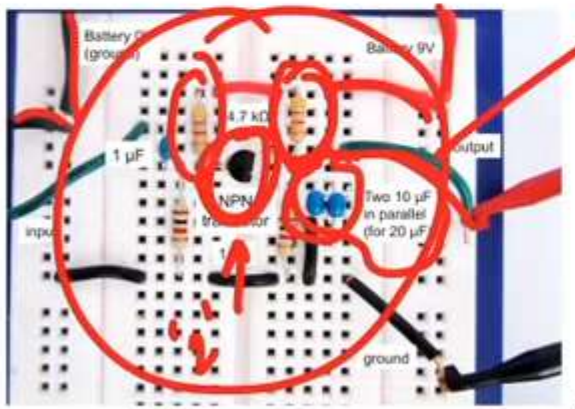


Image source: www.eletimes.com

Circuits using discrete components vs Integrated Circuits (ICs)

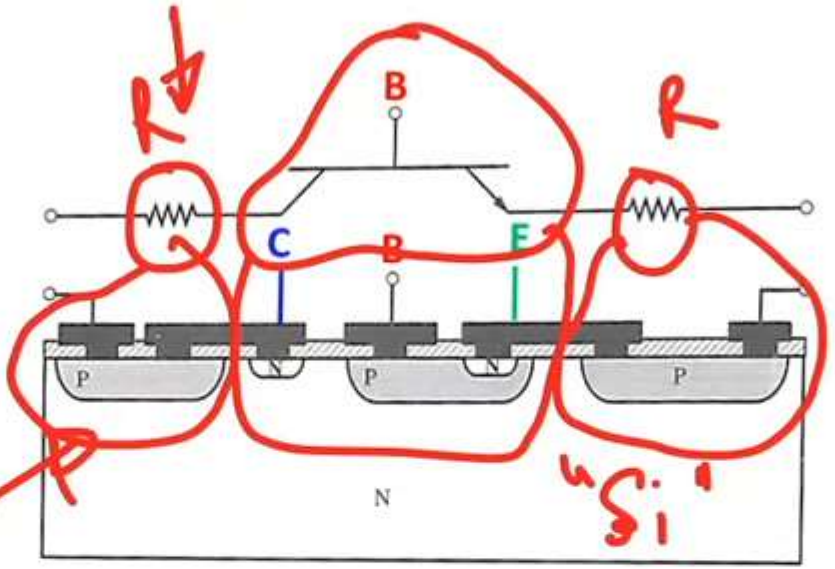


Discrete components 1*



2*

Circuit using discrete components



Integrated Circuit (IC)

Integrated Circuits

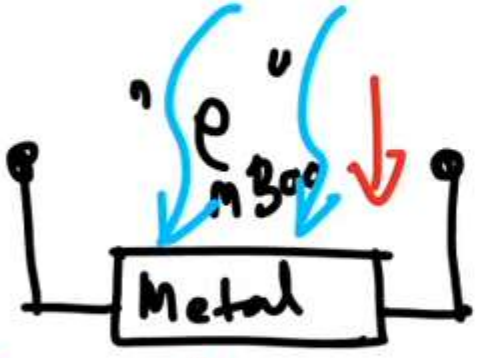
Integrated circuit is a set of electronic circuit on a small piece of semiconducting material primarily silicon. Integration of large number of electronic components (both active and passive) on a single chip results in reduction in size, cost and power consumption, and increase in operational speed and reliability.

Image sources: 1* wikipedia.com, 2* backyardbrains.com, 3* mphysicstutorial.blogspot.com

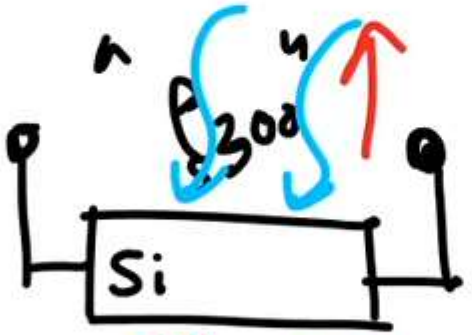
Semiconductors

Material (Conductivity)

- Metal (Conductor) → Al, Cu, Au, Ag
- Insulator → glass, plastic etc.
- Semiconductor → Si, Ge, GaAs



T↑, e↓



T↑, e↑

light → e↑

$T_1 = 300\ K \rightarrow T_2 = 400\ K$

Semiconductors

"Doping".
Conductivity can be modulated

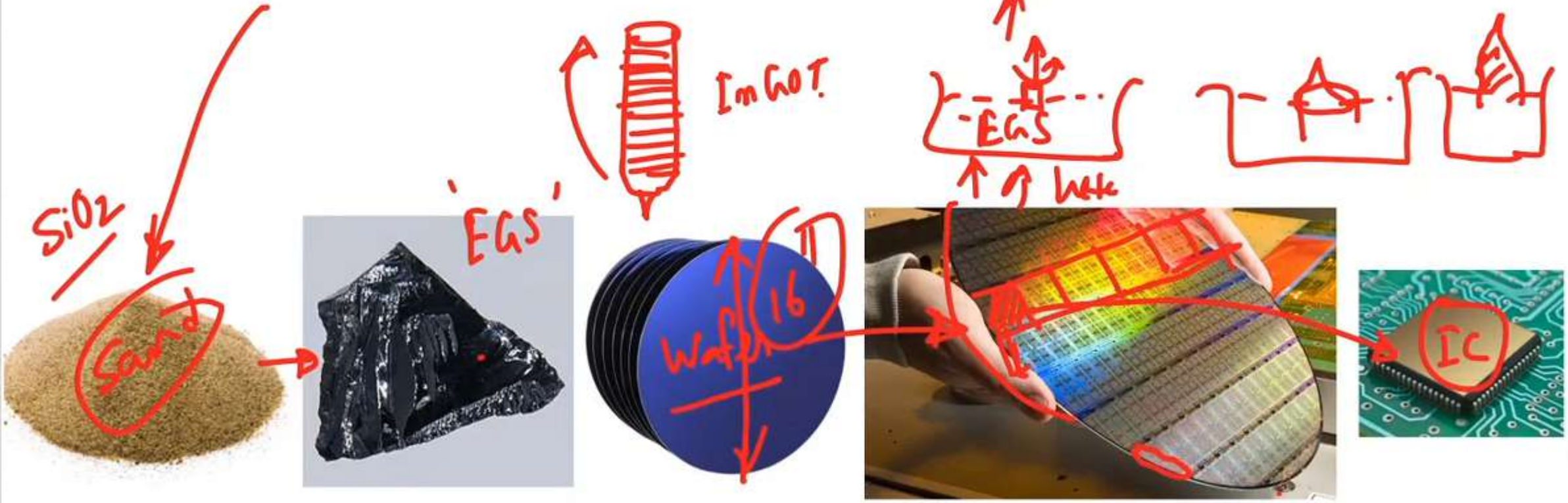


Image source: www.everythingrf.co, wikipedia.org, recofiltration.com, www.wisegeek.com

Carriers in a Semiconductors: electrons and holes