EE40
Lecture 1
Venkat Anantharam

1/23/08

Reading: Chap. 1

EE 40 Course Overview

- EECS 40:
  - One of five EECS core courses (with 20, 61A, 61B, and 61C)
    - introduces "hardware" side of EECS
    - prerequisite for EE105, EE130, EE141, EE150
  - Prerequisites: Math 1B, Physics 7B
  - Course involves three hours of lecture, one hour of discussion and three hours of lab work each week.
- Course content:
  - Fundamental circuit concepts and analysis techniques
  - First and second order circuits, impulse and frequency response
  - Op Amps
  - Diode and FET: Device and Circuits
  - Amplification, Logic, Filter
- Text Book
  - Electrical Engineering: Principles and Applications", Allan R. Hambley, Pearson Prentice Hall, **4th Edition**
  - Supplementary Reader (written by Prof. Chang-Hasnain).

Instructor

- Venkat Anantharam
  - Office: 271 Cory Hall
  - Office hours: M 2-3, Th 3-4
- All emails to me should be forwarded by the Head GSI.
- Head GSI: Bart
- mbharat@cory.eecs.berkeley.edu

Important DATES

- Office hours, Discussion and Lab Sessions will start on week 2
  - Stay with the Discussion and Lab session you registered for.
- 3 tests and 1 Final:
  - Tests: In Class Friday 2/22, Wednesday 3/19, Wednesday 5/7.
  - Location: 10 Evans (+ maybe another location TBA)
  - Final: 12.30 – 3.30 pm Friday 5/16/2008 (Exam Group 5)
  - Location: to be announced
- Best Final Project Contest
  - Monday 5/12, 6-8 pm Location TBA
  - Winning projects will be displayed on the second floor in Cory Hall.

Grading Policy

- Weights:
  - 9%: 10 HW sets - drop one lowest point; hence each is worth 1%
  - 18%: 10 Labs
    - 7 structured experiments (each is worth 1.5%)
    - one 3-week final project (7.5%)
  - 39%: 3 tests – each one is worth 13%
  - 34%: Final exam
- No late HW or Lab reports accepted
- No make-up exams.
- Departmental grading policy:
  - A typical GPA for courses in the lower division is 2.7. This GPA would result, for example, from 17% A's, 50% B's, 20% C's, 10% D's, and 3% F's.

Grading Policy (Cont'd)

- Weekly HW:
  - Assignment on the web by 5 pm Fridays, starting 1/25/07.
  - Due 5 pm the following Friday in HW box, 240 Cory.
  - On the top page, right top corner, write your name (in the form: Last Name, First Name) **with discussion session number**.
  - Graded homework will be returned one week later in discussion sessions.
- Labs
  - Each lab is graded with 30% on Prelab and 70% on Report.
  - **You must complete the prelab section before going to the lab.** The prelabs are checked by the GSIs at the beginning of each session. If prelabs are completed during the lab sessions, it is considered late and 50% will be deducted.
  - Lab reports are due exactly one week after your lab is completed.
- It is your responsibility to check with the head GSI from time to time to make sure all grades are entered correctly.

Classroom Rules

- Please come to class on time.
- Lectures will be web-cast. However, problems do occur and portions of the webcast have been missed in previous semesters.
- Turn off cell phones, pagers, radio, CD, DVD, etc.
- No food and No pets.
- Do not move in and out of or around the classroom.

Chapter 1

- Outline
  - Electrical quantities
    - Charge, Current, Voltage, Power
  - Sign conventions
  - The ideal basic circuit element
  - Circuit element I-V characteristics
  - Construction of a circuit model
  - Kirchhoff's Current Law
  - Kirchhoff's Voltage Law

Electric Charge

- Electrical effects are due to
  - separation of charge → electric force (voltage*charge/distance)
  - charges in motion → electric flow (current)
- Macroscopically, most matter is electrically neutral most of the time.
  - Exceptions: clouds in a thunderstorm, people on carpets in dry weather, plates of a charged capacitor, etc.
- Microscopically, matter is full of electric charges
  - Electric charge exists in discrete quantities, integral multiples of the electronic charge -1.6×10^{-19} *Coulomb*

Etymology

- The word electric is derived from the Greek elektron (Latin electrum) denoting amber.
- It was discovered in ancient times that when amber is rubbed it attracts feathers, dried leaves, etc.
- This is due to the amber becoming charged (discovered much later).
- These are the roots of our subject.

Electric Current

Definition: rate of positive charge flow

Symbol: i

Units: Coulombs per second ≡ Amperes (A)

Note: Current has polarity.

$i = dq/dt$ where

q = charge (Coulombs)

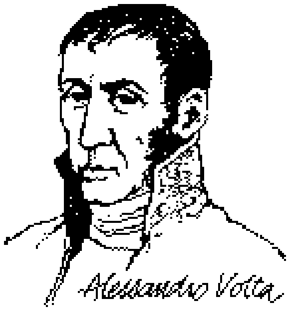
t = time (in seconds)

André-Marie Ampère

1775-1836

Electric Potential (Voltage)

- **Definition**: energy per unit charge
- **Symbol**: v
- **Units**: Joules/Coulomb ≡ Volts (V)

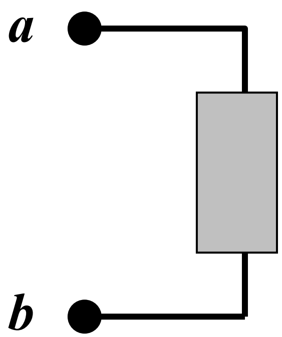


Alessandro Volta
(*1745–1827*)

$$v = dw/dq$$

where w = energy (in Joules), q = charge (in Coulombs)

Note: Potential is always referenced to some point.

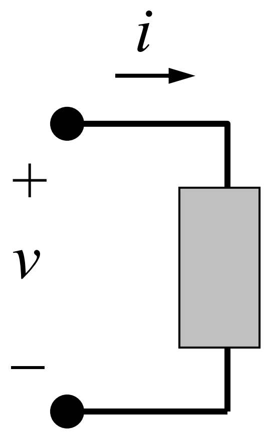


Subscript convention:

v_{ab} means the potential at a minus the potential at b.

$$v_{ab} \equiv v_a - v_b$$

The Ideal Basic Circuit Element



- Polarity reference for voltage can be indicated by plus and minus signs
- Reference direction for the current is indicated by an arrow

Attributes:

- Two terminals (points of connection)
- Mathematically described in terms of current and/or voltage
- Cannot be subdivided into other elements

Circuit Elements

- 5 ideal basic circuit elements:
  - voltage source
  - current source
  - resistor
  - inductor
  - capacitor

Voltage source and current source: ***active elements***, capable of generating electric energy

Resistor, inductor and capacitor: ***passive elements***, incapable of generating electric energy

- Many practical systems can be modeled with just sources and resistors
- The basic analytical techniques for solving circuits with inductors and capacitors are similar to those for resistive circuits