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:
  – 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 $\rightarrow$ electric force
    \[\text{(voltage} \times \text{charge/distance)}\]
  – charges in motion $\rightarrow$ 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 $-1.6 \times 10^{-19}$ 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 $\equiv$ Amperes (A)

**Note:** Current has polarity.

$$i = \frac{dq}{dt} \quad \text{where}$$

$q =$ charge (Coulombs)

$t =$ time (in seconds)

André-Marie Ampère

1775-1836
Electric Potential (Voltage)

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

\[
v = \frac{dw}{dq}
\]

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

• 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