Wed. 1/11 Thurs. 1/12 Fri. 1/13	Introduction **Ch 1.1 - .8** Basic DC Circuits, & *skim* **Ch 7** **Ch 1.9-.10** Intermediate DC Circuits & **App. A** pg. **A-1-A-4**	
Mon. 1/16 Wed. 1/18 Thurs. 1/19 Fri. 1/20	**Ch 1.11-.13** & *lightly* **Ch 6.1, .3, .4, .8, .10, .11** **Quiz** Ch 1 & 6, **Lab 1:** DC Circuits More of the same **Ch 2.1-2.5:** Capacitors	**HW1**: Ch1 Pr 4, 25; Ch 6 Pr 9*, 12 **Lab 1 Notebook**

I must end at 11:30 to give them time for ECCE

Equipment
- **Syllabus**
  - **w/ Schedule, Errata, and Homework Notes**
- **My Schedule (for setting office hours)**
- **ECCE**

Announcements
- **Meeting Location:** Most of the semester we'll actually meet down in Room 102, the little one, second from the other end. That's appealing because we'll be the only ones in there, so we can comfortably lab leave equipment out. So we'll be down there tomorrow afternoon.

Today's Agenda
- **General Intros**
- **A "pre-test"**
  - Since that might sound a bit peculiar and off-putting, I'll pause a moment and explain. It will have no impact on your grade. For evaluating the effectiveness of a course, pre-tests provide "before" snapshots so that, when more common post-tests are compared against them, one can better determine the impact of the course itself.

Introductions
- **Me**
  - **3 relevant points**
    - **Third time teaching Electronics –** so most hiccups should be smoothed out, but I'm always introducing new ones
    - **My Specialty is Experimental Condensed Matter, a.k.a. Solid State, Physics**
      - **Condensed Matter / Solid State –** largely concerned with the *fundamentals* of electronic properties
      - **Experimental –** Experience *using, designing, building, diagnosing, fixing,…* electronic devices and instruments
- **You**
  - **Introductions all around –** While I happen to know each of you, I don't believe all of you know each other; so how about introductions all around – year, what brings you to the course (I know, for many of you it's because we 'make' you take it.)

- **Course**
  - **Simple foundations – Powerful Structures**
    - As in computer programming, the building blocks of Electronics may be simple, but they can be connected in infinitely different ways to accomplish

any variety of tasks. In a way, this is a very tangible reflection of the field of physics as a whole – very few fundamental laws and facts, but a heck of a lot can be understood and modeled base on those.

- **Place in Curriculum**
  - It's always important to know how different courses fit into the context of your larger educational programs. Especially for those of you taking this course 'because we make you', I think it's worth starting off by contextualizing the course in the Physics program.
    - 1) **Foundation.** Electronics is a technology of applied electricity and magnetism and quantum mechanics – so this course stands on the shoulders of ones you've taken in our curriculum.
    - **2) Application.** Virtually every tool of experimental physics is electronic these days – so if you want to understand, modify, or build your tools, you need to understand Electronics.
    - 3) **Skill Areas.** Scientists have three general tacks for exploring a question / system –
      - Theoretical (pencil & paper)
      - Computational (computer),
      - and Experimental (nuts and bolts).

      Independently, these provide three different ways of furthering our knowledge, but together they can check each other and give a rich 360° perspective. In this course the three approaches will complement each other in valuable ways.
    - 4) **Approach.** As in any physics course, rigorous and logical problem solving are essential. In fact, Electronics will likely test and hone your *meticulous* approach like no theoretical course can – one trivial mistake (like a loose connection) and the circuit just taunts you. That may sound like a bad thing, but you become a more focused and exacting thinker for it.

  - **Unique focus – making nature work for you:**
    - This course is unique in our Physics curriculum in that it's focused less on understanding how the world works and more on understanding how to make it work for you – invoking broad stereotypes, that's more of an engineering kind of focus.
    - After Advanced Lab, it's more hands-on course; sure you've got to understand the theory, but the point is *applying.* Some students love that practical emphasis; others find it frustrating to work with messy reality rather than tidy theory. Mind you, based on APS data, something like 70-80% of physicists are experimentalists. So it's important to get good at 'hands-on', either because you're going to be doing that kind of thing yourself, or because you're going to be communicating with folks who do.

- **Goals**
  - Through this course, you should try to get yourself to the point that you

        - *know* most of the *basics*,
        - *can learn more on your own* by reading or talking with others,
        - *can work independently* and *do your own troubleshooting*.
- **Subject levels – language analogy**
    - There are many levels of understanding in electronics. A complete understanding of electronics ranges from the *physics* of *solid state* devices to the *engineering* techniques of *design* and *construction* of complete instrument systems. In many respects, Electronics and circuitry is like a language. In fact, like a language, electronics are often used to logically process information. The electronics-language analogy includes how the different structural levels are related. Appealing to that analogy will help to clarify how deep we're going to go into the field of Electronics. So, a language is built of *words, sentences, paragraphs, and documents;* the analogous stages of electronics are:
        - **1. Components** – like a simple *word*, this is the fundamental building block of a circuit. There are resistors, capacitors, diodes, inductors,…
            - **Function & Rules.** You want to know what functional role each plays / what rules characterize its use.
        - **2. Circuits** – like a *sentence*, it's built of the "words" / components and there's a self contained logic to a circuit.
            - **Theory of operation** – you want to be able to 'read' a circuit and understand the role / behavior of each component.
            - **Circuit design** – you also want to be able to 'write' / design a circuit to behave the way you want.
        - **3. Devices** – like a *compound sentence or a paragraph*, this device is designed to perform a certain job (e.g. – an amplifier or digital logic circuit), and it often requires the coordination of a few simple circuits to perform that job.
            - **Theory of operation** – again, you want to be able to 'read' the device – understand what it does and how it does it.
            - **Circuit design** – and you want to be able to 'write' / design a device - choosing and arrange the sub-circuits.

          There are two types of devices we'll encounter
            - **Discrete** wired circuits – using individual components connected by wires or the traces of a printed circuit board.
            - **Integrated** circuits – all components and connections produced on one chip.
        - **4. Instruments** – Like a *document* has one (possibly complex) thesis, makes a handful of supporting points, an instrument has one main purpose, but it takes a number of devices to handle each piece, e.g., a digital voltmeter, signal generator, oscilloscope, your cell phone,...

- **Our Emphasis**

  In this class, we will treat these four levels with the following emphases:
    - **Components and their Basic Physics** (our *usual* area of emphasis in physics classes) will be covered *lightly*.
    - **Circuits and Devices** will form the *main focus* of the course.

- Some **Instruments** will be discussed as examples.
- **Hands-on.**

Syllabus (handout)

- Now that you have some vague sense of *what* we're about, let's look at the syllabus and see *how* we're going about it. (You should, of course, read this over on your own.)
  - **Emphasis**
    - **Hands-on.** Flip to the 3rd page and take a look at the grade breakdown. Notice that Labs + Projects gets 45% of your grade. Labs and projects are the main parts of the course since it is about electronics applications.
  - **Website.** Reproduces the pieces of the syllabus (policies, schedule, homework notes, errata). It also has links (through the schedule) to quiz topics and equations, lab handouts, and old lecture notes.
  - **Office Hours (**pass out my schedule) I'm passing around a copy of my schedule; in the time slots that I'm available (not grayed-out) please mark "g" if it's good for you and "b" if it's bad for you.
  - **Text** I hope you all got it. While it's supposed to be the best *aimed* text for this course, it's got a lot of errors (owing to the death of the primary author before revisions could be made).
    - **Errata** Dr. DeWeerd has compiled and a few of us have added to an Errata - a list of corrections that I *strongly* encourage you to make to the text immediately.
  - **Programs.**
    - **Pre-lab.** Along with each lab are some pre-lab exercises which involve modeling some of the circuits you'll build. Those will also serve to ease you into / teach you using a modeling program.
    - **Tool of Professionals.** Folks who design and diagnose circuits and devices for a living do some of their thinking with pencil and paper (theoretically), but also do a great deal of it with circuit simulation packages (computationally.) An electronic *device* or *instrument* can be far too complex to diagnose without these simulations.
    - **Tool for your Project.** Similarly, your 'independent project' will probably be too complex to diagnose without this tool. So, my aim is that by the time we get to 'independent project' part of the course, you'll have become quite familiar with this tool, and you'll find it very helpful in diagnosing the circuit that you're constructing.
    - **Tool for homework check.** I should add that, all along the way, you should be able to check much of your homework by quickly building a simulation – just one small example of how a scientist's theoretical and computational tools complement each other.
    - **The specific programs.** One such package that's conveniently free and fairly easy to use is 5Spice (available at www.5spice.com); unfortunately, it's only available for Windows (some other free package may be available for Mac's), but we do have it on all machines in the department. You may also find the online circuit simulation at www.falstad.com useful – they have pre-build many common circuits, so if you find one like the one you're interested in, you can modify it.

- **Reading & Discussion Prep.** Read before class and do some form of prep (which you'll turn in by 9a.m.) I'm flexible about the form that the preparation takes so you can do whatever's most useful to you: posing questions you'd like covered in class, filling in 'left to the reader' steps, working unassigned problems, taking a first stab at assigned problems,… I ask that you do 3 items each time (that may be 3 questions, one question and two unassigned problems,…)
- **General Structure:** class-class-lab-(lab) cycle
    - First, you read the material, then we talk about it and work on the theory, then you get experience with it experimentally.
    - This first week's a little odd, but generally, I've set aside two days for class, one 170-min lab period and one 80-min lab period (so you've got plenty of time if you need it.)

- **Lab:** Two things you've got to know:
    - Come prepared if you want to leave finished
        - You'll get the handouts before lab (they're already all posted, but at the moment only the first three are updated for this year), so familiarize yourself with them.
        - **Hand out copies**
    - You'll be keeping semi-formal notebooks
        - Everything goes in them.
        - There's a check list at the beginning, similar to what most of you have seen in Phys 233 or Advanced Lab.

- **Homework:** Weekly. Communication & content count as well as final answer. If your first pass is correct but incomprehensible, then by all means, turn in a second draft.
- **Projects:** The last two weeks of class are devoted to a project of your own choosing (of course, I'll help you to choose as the time comes).
- **Quizzes:** Weekly, at the beginning of lab.
- **Exams:** Two: midterm and final – don't plan any non-academic conflicts for the final.
    - **Scheduling Final:** You'll notice that we've got some choice of exactly when we have our final. I'd like you to look at those, find out when your other finals will be, and then get back to me about when would work well/poorly for the final. We'll make a decision this Friday.
- **Cheating:** Just to have it out there – the academic process relies on trust – that we're not B.S.-ing each other. By all means, work together, but what goes down on the paper must reflect *your* understanding – otherwise, I can't accurately do my job of evaluating what you're learning and you could come out of the class being able to -
    - *know* most of the *basics,*
    - *can learn more on your own* by reading or talking with others,
    - *can work independently* and *do your own troubleshooting*.

For next time – see schedule, and don't forget to turn in your 3 items of prep (can be emailed in.) Since we meet at 1pm tomorrow, and I've a meeting at noon, please get me your prep by 11:00.

ECCE

Think of this not as a test of what you *don't know* but an assessment of the *head start* you have. Again, this won't have any impact on your grade, but, should the department want to change the course, this part of the 'before' snapshot will be useful. Thanks.