Section A
Preliminary Material and (shudder) Necessary Physics and Chemistry
(Chapter 3: Sections 3.1 and 3.2 of your text – PLUS some supplementary stuff!)

Section A1: Introduction & Goals

Those of us who are, or aspire to be, technical professionals many times overlook the necessity of the physical sciences. We want to build, we want to design, we want to solve problems and we don’t want to deal with all the underlying stuff...

Unfortunately, this is not the case. To be a truly effective design engineer, whether it is at the device, circuit or system level, the importance of an understanding of the fundamentals of semiconductor materials cannot be overstated. As we have all learned, things rarely (if ever) work the way that they are “supposed to” without any deviations or contradictions. Well... the same is true for electronic devices, circuits and systems. If you don’t have an idea of why something is supposed to happen or how something is supposed to work, you will be at a serious disadvantage when it comes to making simplifications (a practice I wholeheartedly endorse and one that will save, if not your life or your sanity, at least LOTs of work), performing and interpreting computer simulations, and understanding and effectively utilizing manufacturer’s data sheets.

With this in mind, the goals of this section are:

- to provide a review of atomic composition and crystalline structure for specific semiconductor materials;
- to define and differentiate the three main types of solids and the conductive properties of each;
- to describe the formation of extrinsic semiconductors from intrinsic material;
- to illustrate the mechanics of current flow in semiconductors; and
- to put it all together and form a junction of dissimilar materials!

Although there will be no test questions specifically on the material in this section (HOLD ON – don’t leave yet!), it will make your life much easier if you take some time and get comfortable with these concepts! Virtually everything that we will be studying in this course and its follow-on
(ETEE3212) will be made easier if you can visualize what is physically happening. Not only that, but you may be able to impress the mess out of others in your professional life if you can present a “guestimate” on characteristics, behaviors or best practices without frantically having to search for the ever-elusive equation!

_OK, I’ll get off the soapbox about this (for now). Let’s get into what’s happening..._