

Syllabus: Physics 322b-Solid State Physics – Fall 2007

Walter Smith – Haverford College

Solid State Physics is by far the most productive area of current physics research, both in terms of number of articles published annually and of practical technologies and products. In this class, we will concentrate on crystalline systems, and especially on their electronic properties. Such systems form the basis for conventional transistors, as well as exciting new developments such as quantum electronics. This course is less “fundamental” than the other lecture courses at Haverford, since we shall mostly be applying ideas from classical mechanics, quantum mechanics, statistical mechanics, and E&M to solid state materials. You will find these “applications” of other physics to be both interesting and challenging. You will find many opportunities for satisfaction and pleasure if you invest the necessary work in the course.

Instructor:

Walter Smith	INSC L110	Office hours:	M 2-4,
	896-1332(office)		Tu 10-11,
	896-1565 (home)		Th 10-11
	wsmith@haverford.edu		F 1:30-2:30
			or by appointment

Electronic mail is always welcome. I will occasionally send you mail and announcements. **As a participant in this course, you are required to check your e-mail daily for corrections about problem sets, etc.**

A good way to get together is to arrange (after class) a mutually agreeable time. Please do not hesitate to contact me; no question or topic is too small.

Feedback: If you have concerns about the course or ideas about how to make it better, you should let me know *immediately*, either in person or by e-mail. Don't wait!

Location and times:

- *Classes*- MWF 10:30-11:30, H106
- *Recitation* - Time and location TBA. During these sessions, we will work through additional problems. We'll also discuss any questions you may have. (I certainly expect you to ask numerous questions during our regular class meetings, but it sometimes happens that you have a question about some old topic or some other question which you prefer to reserve for recitation.) We will not meet for recitation during the first week of classes.

Text:

- James D. Livingston, *Electronic Properties of Engineering Materials* (Wiley 1999)

There is no one textbook which is really adequate for our needs. Livingston's book is unusually well-written and easy to learn from, and will serve as our primary text. It gives an up-to-date view from an engineering perspective. We will speed through the first seven chapters, which cover important topics that are usually thought about from a classical point of view. The second part of the book adopts the quantum mechanical approach which is needed to understand most electronic properties of solids, and we will work through this more carefully. **Please remember that Livingston will serve as an excellent reference in future**

years, both to brush up on elementary topics, and as an introduction to more advanced areas.

Livingston does not cover all the topics we need, so we will supplement with reserve readings from other texts.

Assignments and Tests:

- Written work will be assigned weekly, and is due at the start of class on the assigned date, ordinarily the Friday of the week. There will also be assigned reading to prepare you for class discussion. You will also undertake one substantial final project; the number of problems on the weekly assignments will be reduced while you're working on it.
- There will be two take-home examinations, (90 minutes each) plus a take-home final exam.

Grading procedures for specific elements of the course:

- Written exercises-- **We will use a two-pass procedure for handling problem sets – please read carefully! PLEASE USE REGULAR PENCIL OR BLACK INK FOR YOUR PROBLEM SETS!!** After you turn in a problem set, I will grade it using red ink. Half of the grade for the homework will be based on this first grading pass.

Your paper will then be turned back to you **at your next class meeting**, along with “skeleton” solutions. (These are not complete written-out versions of the problems, but rather guidelines and waypoints to help you along.) At this point, consulting the skeleton solutions as needed, **using blue ink or blue pencil**, and writing on the same paper you originally turned in, you will complete any problems which you were unable to do at first, and write out complete corrections to problems which you did incorrectly. The goals of doing the grading this way are to ensure that you understand each problem fully, and also to give you a “second chance” on problems that you muffed. You will then turn in your revised problem set on the following Friday in class. I will check over your revisions (using green ink for grading!), and assign the remaining 50% of the grade. In principle, everyone should have a perfect revised version, since you may consult the skeleton solutions as needed in preparing this.

To make this whole scheme work, it is essential that you leave space on your problem set to write in corrections. You may wish to leave space at the bottom of each page, or to use the back of the preceding page.

You will be graded on the presentation and comprehensibility of your assignments. This does not mean that we require you to have neat handwriting! However, we do expect you to make an effort to make your writing legible. Perhaps more importantly, we expect you to present your problems in a logical and easy-to-follow manner. The grader will mark with a circled “P” (for “presentation”) any problem which is not presented clearly. You will receive a one point deduction for each P beyond the first two. (A typical problem or significant subpart of a problem is worth 2 or 3 points.) **For the first two assignments, no deductions will be taken for P's.** This will give you a chance to get used to my expectations. **If the reason you got a P for any problem is not clear, please see me about it.**

- Exams--understanding is the key. Partial credit will be given for sensible efforts even without a completely correct answer. We will also use a two-pass system for the exams; the first pass will receive 60% weighting, and the second pass 40%.
- Your final course grade will be computed using the following weighting

First exam	13%
Second exam	17%
Final exam	25%
Final Project	10%
Weekly Assignments	35%

Late policies:

- The following late penalties will be in effect for homework. You are permitted two 1-week extensions without any penalty during the semester when you are stressed out with work. Just turn in a sheet of paper indicating that you are giving yourself a "free extension." The two extensions must be used for separate problem sets; they cannot be combined to get a two-week extension on one problem set. Save them for when you really need them. Other than these extensions, work turned in late will not be graded, unless an extension is granted in advance for truly unusual circumstances (e.g. death in the family or serious illness). **As in most physics classes, these weekly assignments are one of the central learning experiences of the course, and so your performance on these receives a heavy weight in the overall course grade. Please be diligent about starting on the homework early each week, and getting it in on time.**
- Exams must be turned in not later than the stated times, except by prior agreement.

Honor code matters:

We value Haverford's honor code for the integrity it fosters and the pedagogical flexibility it affords. The important guiding principle of academic honesty is that you must never represent the work of others as your own. The following guidelines should govern your behavior in the course; please request clarification if you find yourself in any doubtful situations.

- You may seek assistance from the instructor or from your fellow students in doing the weekly assigned exercises and preparing for class discussions. You may also work together with other members of the class on these assignments and this is often quite beneficial. For your own good, avoid situations in which you are either contributing either too much or too little to such collaborations. Just copying someone else's work is clearly a representation of another student's work as your own and is a violation of the Code. Some "individual problems" will be assigned on each problem set; you may consult with the instructor as needed for these, but you may not consult anyone else.
- Solutions to the written exercises will be made available on the due date. **(If you are using one of your free extensions, you should not consult the solutions until after you have turned in your assignment.)**
- The take-home exams must be entirely your own work. Detailed instructions will be given on the exams themselves and discussed in advance. You will be allowed to use a page of equations prepared in advance, and a calculator, but no other materials. No collaboration of

any sort is allowed once you start an exam. The allowed time (a single contiguous block) must be strictly observed.

- Honor code guidelines for the lab are contained in the lab manual.

Advice

The following suggestions are based on the experience of previous students:

Review your class notes between lectures, and come prepared to ask questions. *Annotate* your class notes as you read them.

Stay up to date on the reading; preferably read the assigned material *twice*; for example, once before the relevant lecture, and once after.

Read with pen in hand to work out things described only briefly in the text or lecture. Ask yourself "what is the main point of each section", and *answer* the question.

When you take notes in class, *don't just write down equations!* Qualitative information is often essential!

You need to allocate about 8 hours for study and homework per week (plus class time).

When you're studying for an exam, review the *solutions* to problems and previous exams.

Remember that if the material is new or unfamiliar for you, learning will take time, just as learning a new language takes time. Try not to become discouraged if the going is rough at times, and don't prejudge your ability to master the material.

Exam Schedule:

Exam 1 will be distributed 10/8/07 and due 10/12/07; Exam 2 will be distributed 11/26/07 and due 11/30/07. The final exam will be held during finals week. (!)