

Physics 340: Condensed Matter Physics

Gustavus Adolphus College Spring 2017

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Required Textbooks:

Fundamentals of Condensed Matter and Crystalline Physics, Sidebottom (2012)

Other texts used in this course (but not required to buy):

An Introduction to Thermal Physics, Schroeder (2000)

– plenty of senior students should have this to borrow

Solid State Physics: An Introduction, Hoffman (2009)

– I have one copy available

Other useful texts:

Elementary Solid State Physics, Omar (1975)

– Previous book used for this course, very dense

Modern Physics for scientists and Engineers (2nd ed, 2004), Taylor, Zafiratos & Dubson

– you should own this from a previous course

Course website: <http://physics.gac.edu/~petricka/courses/340spring.html>

Course Policy and Evaluation

1. **Class Meetings:** The class will meet three days a week at (MWF) for lecture and discussion. The student will be responsible for reading the text before coming to class.
2. **Homework:** Homework will be assigned on a regular basis, turned in to the instructor, graded and returned. Written homework sets must be neat and organized. Legibility and thorough explanations of answers are required, **thought and solution process will many times receive higher emphasis than final answers.** Illegible homework (and exams) will remain unscored at the instructor's discretion. You are encouraged to discuss and work problems with other classmates, professors, and me. However, each student must submit their own work; copying or internet solutions are not allowed, and is considered cheating.
3. **Laboratory:** There will be approximately ten required laboratory experiments. Students will work in groups of two or three on these experiments. Each group will maintain a **single (group)** laboratory notebook for these experiments which will be collected and graded at midterm and again at the end of the term. Contents of the notebook are expected to be as you learned in PHY-305. A formal report in the style of a short scientific letter (as discussed in PHY-305) will be prepared by each **group** (you must work together) for several labs (see schedule) over the course of the semester. The due date for the papers is two weeks after the corresponding lab, but it is clearly not in your best interest to wait to do your write up.

4. **Project:** Each laboratory group will select a project to be completed in the second half of the semester. The group will be expected to keep a very detailed notebook of their results and present their results at the end of the semester.
5. **Attendance:** Regular attendance at all lectures and laboratories is expected and absenteeism will result in a reduction of the final grade. Participation in all classroom and laboratory activities is expected and is part of the students' final grade. If you miss for any reason you are responsible for the material covered during the class, including any assignments.
6. **Quizzes:** Pop quizzes will be given at the discretion of the instructor.
7. **Exams:** There will be three one-hour exams and a comprehensive two-hour final exam.
8. **Missed Exams:** Students are expected to arrange in advance to take an exam at other than the announced time. Requests to reschedule exams for non-emergency personal reasons will be declined. Permission to make up a missed exam after the fact will be at the discretion of the instructor and should not be assumed.
9. **Incompletes:** A grade of incomplete will be given only for work not completed due to circumstances beyond the control of the student (college policy).

10. **Evaluation:** The following scale will be used as a guide only:

A	94 - 100	C+	74 - 78
A-	90 - 94	C	70 - 74
B+	86 - 90	C-	66 - 70
B	82 - 86	D+	62 - 66
B-	78 - 82	D	58 - 62
		F	0 - 58

Exam 1: 10%

Exam 2: 10%

Exam 3: 10%

Final Exam: 10%

Homework: 20%

Lab papers: 20%

Lab notebook: 10%

Lab effort: 10%

Project component: The effort, notebook and presentation components of the project will be counted toward the regular grade in this course. However, the components of the project **will also be graded separately** for the pass/fail component of PHY-365. For PHY-365 the grading will be **PASS (>76%) / FAIL (<76%)** and the components will count as

10% Project determination and selection	30% Effort	10% Results
30% Lab notebook of project	20% Presentation	

Assignment of final letter grades will also take into account the instructor's subjective evaluation of the student's attendance, initiative, class participation, preparation, and evidence of improvement.

12. **Disability:** We work together to ensure ‘reasonable accommodation’ and non-discrimination for students with disabilities. A student who has a physical, psychiatric/emotional, medical, learning, or attention disability that may have an effect on the student’s ability to complete assigned course work should contact the Disability Services Coordinator in the Advising Center, who will review the concerns and decide with the student what accommodations are necessary.

13. **Laboratory (continued):** Condensed Matter Physics is a lab course. The lab is nominally scheduled through the registrar. However, because of the limited resources for this course, we will have to meet by arrangement. If everything is working properly, and groups manage their time, labs should take one lab period to complete.

14. **Laboratory (continued 2): Written reports:**

INTRODUCTION:

You are a research physicist during the 20th century. Your job is to conduct experiments, make discoveries, and publish results. You hope to become famous and win a Nobel Prize before the age of thirty, so the quality of your publications is very important. The results of your research are to be published in *Solid State Physics* or a similar journal. Most journals accept results published in “scientific letter” style (described below). Good luck making history!

INSTRUCTOR'S NOTES:

Philosophy of Reports - I want you to take your role as a research physicist seriously! I am the editor of the journal in which you are trying to get your papers published. You are to write on your **research** not **just a lab**. Whether or not your papers are accepted for publication (and your lab grade) depend on how well the paper is written and the quality of the scientific evidence you present to support your findings. You must convince me that your results are real, and worthwhile!

I. Scientific Letter Format for PHY-340 - The scientific letter style of presenting experimental results is a short paper used to announce significant new findings or discoveries. The writing level, style and general format of your written assignments is that expected from PHY305. For this class, the following formatting rules apply. The title page should have the title, statement of authorship, and abstract. The **body** of the paper should be **no longer** than two typed pages (**of text, 1.5 spaced, 12 point font**) or its equivalent (latex, etc.). The body, should contain the introduction, theory, experimental setup (no procedure information), results, data analysis, and references. Except for the references section, section headers should not be used.

To refresh your memory from PHY 305, the abstract is a brief summary statement about what was done and the significant results that were obtained. The introduction places the work in context and states why it is important. In the rest of the paper, you are trying to convince the reader that you know what you are talking about. Include anything that you feel supports your conclusions, for example, data tables, diagrams, graphs with captions, and equations. Finally, include a concluding paragraph which sums up the most important results or findings.

Any references used should be properly cited; there must be at least two relevant, non-textbook / non-lab manual / non-website (like Wikipedia etc.) references per paper. Use internet journal searches, the instructor, or other means to find relevant papers.

All figures should be included on their own page and should have complete captions so that the reader can understand what is being shown without referring back to the main text. Each paper should include as many figures as necessary (at least one, but probably not more than three).

14. Course Content and Tentative Schedule: Our content goals are listed in the course schedule. A **definite prerequisite** for this course is the material that you learned in PHY225(QMU) and the lab and writing skills you learned in PHY305(advlab). Material from PHY380(thermal) and PHY390(quantum) overlaps significantly with this course, but will not be expected as a prerequisite. Due to the wide preparation level of the enrolled students, this course may seem too slow, too fast, or both at times. Due to the numerous components of this course it may seem like an extraordinary amount of work. Please do not hesitate to contact me about content and pacing, and workload feedback.