Introduction to Solid-State Physics
Physics 4211, Spring 2019

Instructor: Natalia Perkins

Office hours: Monday, Wednesday 10am-11am in Tate Hall (130-19) or ask for another convenient for you time by email: nperkins@umn.edu

Lectures: Tu, Th (11:15AM-12:30 PM) in PAN 110

Course materials:
Recommended: The Oxford Solid State Basics by Steve Simon
Recommended: Introduction to Solid State Physics by C. Kittel
Recommended: Solid State Physics by N.W. Ashcroft and N.D. Mermin

Prerequisites: I will assume some basic knowledge of thermodynamics, statistical mechanics and quantum mechanics. If you have not taken courses in these areas that doesn’t necessarily mean that you won’t be able to keep up in the course, but you will be responsible for brushing up on these topics on your own. In any case, I plan to start the course with a brief review of basic quantum mechanics and statistical mechanics.

Lecture Notes:
I will post my handwritten notes on the webpage at the end of each week, but I suggest that you take notes in class.

Class Description:
This course is a general introduction to Solid State Physics. It covers the basic ideas and techniques of the subject, plus a number of examples to illustrate how the basic ideas are applied. It is typically taken by advanced
undergraduates in Physics and related fields, and also by graduate students from Physics or EE majors that have had little or no previous exposure to the subject.

The course will be based on “The Oxford Solid State Basics” by Steve Simon and “Introduction to Solid State Physics” by Charles Kittel. I hope you will find both books illuminating. Steve Simon's book also contains a brief list of other texts with comments on their pros and cons, which you might find useful.

Lecture topics:

2. Specific Heat of Solids
3. Electrons in Metals
4. Basic Chemistry of the Solid State
5. Types of Matter
6. Electrons in d=1, tight-binding, Peierls distortion
7. Geometry of solids; crystal structure
8. Reciprocal lattice, Brillouin zones, waves in crystals
9. Neutron and X-Ray Diffraction
10. Electrons in Periodic Potentials I: Nearly Free Electrons
11. Electrons in Periodic Potentials II: Bloch's Theorem
12. Graphene Basics
13. Semiconductor Physics & Devices
14. Semiclassical Electron Dynamics
15. Superconductivity
16. Magnetism
17. Topology in Solids: An Introduction

Mid-terms and Final Exam: There are two in-class mid-term exams throughout the semester. The tentative dates for the mid-term exams are March 5 and April 16. If you have a University approved reason to miss a mid-term exam, please talk with me in advance. The final exam is home-taken. The final exam covers the entire material of the semester.
**Homeworks:** Weekly homework assignments will be posted on the class website. Your solutions to the problem set are due Lectures on Thursdays.

**Grading:**
Your Final Grade for the class will be calculated as follows:
Homework - 40 %, two Mid-term exams – 20 % each, Final exam - 20%. The total grade will be calculated according to the following scheme: 90% and higher will be A; 85-90% will be A-; 75-85% will be distributed between B-, B, and B+; 60-75% will be distributed between C-, C, and C+.

**DEPARTMENTAL POLICIES**
**Athletes:** must provide their official University of Minnesota athletic letter containing the approved competition schedule to their instructor and the staff in Tate 130. Accommodations will be made for official university sports only (i.e. no accommodations will be made for intramurals, club sports, etc.)

**Disability services:** If you have accommodations for this course, please provide the staff in Tate 130 with a copy of your accommodation letter for the current semester. Exams will be arranged according to accommodations and sent to the testing center for administration.

**MANDATORY POLICY INFORMATION**
Student conduct code
http://www1.umn.edu/regents/policies/academic/Student_Conduct_Code.html
Disability Accommodations
http://ds.umn.edu/student-services.html
Use of Personal Electronic Devices in the Classroom
http://policy.umn.edu/Policies/Education/Education/CLASSROOMPED.html
Makeup Work for Legitimate Absences
http://policy.umn.edu/Policies/Education/Education/MAKEUPWORK.html
Appropriate Student Use of Class Notes and Course Materials
http://policy.umn.edu/Policies/Education/Education/CLASSNOTESSTUDENTS.
html
Grading and Transcripts
http://policy.umn.edu/Policies/Education/Education/GRADINGTRANSCRIPTS.
html
Sexual Harassment
http://www1.umn.edu/regents/policies/humanresources/SexHarassment.html
Equity, Diversity, Equal Opportunity, and Affirmative Action
http://www1.umn.edu/regents/policies/administrative/Equity_Diversity_EO_AA.html
Mental Health and Stress Management
http://www.mentalhealth.umn.edu