

PHYS 481/681 CONDENSED MATTER PHYSICS

BASIC INFORMATION

Course prefix, catalog number, and title: PHYS 481/681, Condensed Matter Physics

Number of credits: 3 credit hours

Term and year: Spring 2017

Classes: Tue, Thur 11:00 - 12:15 pm, South Engineering 221

Instructor's name: Prof. Yongki Choi, Guest instructor's name: Dr. Khang Hoang

Office location: South Engineering 220A

Office hours: Tue, Thur 12:15 - 1:00 pm and by appointment

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Physics Teaching Assistants Office Hours: http://www.ndsu.edu/physics/current_students/ta_office_hours/

Student Success Program Tutoring Hours: http://www.ndsu.edu/studentsuccess/tutoring_schedule/

BULLETIN DESCRIPTION

Introduction to the physics of soft condensed matter, composed of polymers, colloids, amphiphiles, and liquid crystals, and of hard condensed matter, including metals, semiconductors, and superconductors, emphasizing phase transitions and materials properties (electrical, magnetic, optical, elastic).

Co-requisite: PHYS 486 Quantum Mechanics II

COURSE OBJECTIVES

The main objective of the course is to develop the conceptual and quantitative methods that are critical for a working knowledge of soft and hard condensed materials. Building on an understanding of classical calculus-based physics at the level of PHYS 251-252 and quantum physics at the level of PHYS 485-486, the course develops the necessary formalisms of statistical mechanics, quantum mechanics, and continuum mechanics. Emphasis is placed on a quantitative description of condensed matter properties directly relevant to measurements and applications.

REQUIRED STUDENT RESOURCES

Recommended textbooks: *Soft Condensed Matter* by Richard Jones, *Introduction to Solid State Physics* by Charles Kittel, *Electronic Properties of Materials* by Rolf Hummel, *Solid State Basics* by Steven Simon, *Intermolecular and Surface Forces* by Jacob Israelachvili, *Soft Matter Physics* by Mohamed Daoud, Claudine Williams, *Solid State Physics* by Neil Ashcroft and David Mermin

SYLLABI ON WEB PAGES

Syllabus, Announcements, and Notes will be posted on our Blackboard course homepage: <https://bb.ndsu.nodak.edu>

HOMEWORK ASSIGNMENTS

Weekly homework will be posted on our Blackboard course homepage. All homework assignments are due on the dates specified. **Late submission will not receive credit.**

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week	Topic	Reading /Assignment
1	Soft matter, scales of force, length and time	Jones, Chapter 1-2
2	Interactions, energy, and glass	Jones, Chapter 2
3	Phase transitions	Jones, Chapter 3
4	Colloids	Jones, Chapter 4
5	Polymers	Jones, Chapter 5
6	Amphiphiles, Self-assembly	Jones, Chapter 9
7	Self-assembly, Soft matter in nature (biopolymers)	Jones, Chapter 9-10

8	Midterm Exam 1	
8-9	Review of Quantum Mechanics	Simon, Kittel, Hummel
10	Crystal structure	Simon, Kittel, Hummel
11	Band structure	Simon, Kittel, Hummel
12	Fermi surfaces, metals and semiconductors	Simon, Kittel, Hummel
12-13	Midterm Exam 2	
14	Optical properties	Simon, Kittel, Hummel
15	Phonons and thermal properties	Simon, Kittel, Hummel
16	Magnetic Properties	Simon, Kittel, Hummel
17	Final exam	May 9 th , (11:00 am - 1:00 pm)

PHYS 481 : EVALUATION PROCEDURES AND GRADING CRITERIA

Final letter grades for the course will be computed using the following weights:

- Homework Assignments 15 %
- Midterm Exam 1 25 %
- Midterm Exam 2 25 %
- Final Exam 35 %
- Total Points 100 %

NO MAKE-UP EXAMS ARE ALLOWED

Grades A: $\geq 90\%$, B: 80 to $< 90\%$, C: 70 to $< 80\%$, D: 60 to $< 70\%$, F: $< 60\%$

PHYS 681 : EVALUATION PROCEDURES AND GRADING CRITERIA

Final letter grades for the course will be computed using the following weights:

- Homework Assignments 15 %
- Midterm Exam 1 15 %
- Midterm Exam 2 15 %
- Project 20 %
- Final Exam 35 %
- Total Points 100 %

NO MAKE-UP EXAMS ARE ALLOWED

*Requirements and assessment of the research project are described in the attached document.

Grades A: $\geq 90\%$, B: 80 to $< 90\%$, C: 70 to $< 80\%$, D: 60 to $< 70\%$, F: $< 60\%$

ATTENDANCE

According to [NDSU Policy 333 \(www.ndsu.edu/fileadmin/policy/333.pdf\)](http://www.ndsu.edu/fileadmin/policy/333.pdf), attendance in classes is expected. Veterans and student service members with special circumstances or who are activated are encouraged to notify the instructor as soon as possible and are encouraged to provide Activation Orders.

AMERICANS WITH DISABILITIES ACT FOR STUDENTS WITH SPECIAL NEEDS

Any students with disabilities or other special needs, who need special accommodations in this course, are invited to share these concerns or requests with the instructor and contact the [Disability Services Office \(www.ndsu.edu/disabilityservices\)](http://www.ndsu.edu/disabilityservices) as soon as possible.

ACADEMIC HONESTY

The academic community is operated on the basis of honesty, integrity, and fair play. [NDSU Policy 335: Code of Academic Responsibility and Conduct](#) applies to cases in which cheating, plagiarism, or other academic misconduct have occurred in an instructional context. Students found guilty of academic misconduct are subject to penalties, up to and possibly including suspension and/or expulsion. Student academic misconduct records are maintained by the [Office of Registration and Records](#). Informational resources about academic honesty for students and instructional staff members can be found at www.ndsu.edu/academichonesty.

*The instructor reserves the right to adjust or modify this syllabus if it is deemed beneficial to student learning

PHYS 681 PROJECT: REFEREE REPORT

GENERAL INFORMATION

Prepare a referee report for an authentic research paper which will be assigned by the instructor. The report should roughly follow the PRL review guidelines (<http://journals.aps.org/prl/referees>) and should contain the following essential elements:

DESCRIPTION

The project is intended to measure students' research-associated qualities including independent thinking, critical reasoning, and research skills.

- Summarize the article (1 page)
- Give your main assessment of the article, including whether it is novel and interesting, whether it has a sufficient impact and adds to the knowledge in the community (1 page)
- Evaluate quality of Research and Presentation (1 page)
- Give specific comments and suggestions (more than 3 pages)
 - Layout and Format
 - Title
 - Abstract
 - Introduction
 - Graphical Abstracts
 - Method
 - Statistical errors
 - Results - data and figures
 - Discussion
 - Conclusion
 - Language
 - References
- Make your final recommendation (1/2 page)
 - Reject (explain reason),
 - Revise – either major or minor (explain the revision that is required)

DEADLINES

Final written report: Due May 1st.