

Course Syllabus for PHYS680 — Introduction to Nanophysics

Course Information

Semester: Fall 2020

Credit hours: 3

Class time: Mondays and Wednesdays 11:00AM-12:15PM

Class room: Lectures 100% Online; Midterm-Capital room; Final exam-to be determined

Textbooks: Nanophysics and Nanotechnology: An Introduction to Modern Concepts in Nanoscience, 3rd Edition (Recommended)
Edward L. Wolf, ISBN: 978-3-527-40651-7
Mesoscopic Electronics in Solid State Nanostructures
Thomas Heinzel, ISBN: 978-3-527-40638-8

Instructor Contact Information

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Teaching Philosophy

1. A teacher should be a good motivator.
2. A course's outcome should be judged by how much the students learned rather than how much the teacher taught.

Course Description

Characterization, fabrication, imaging, manipulation, and physical properties of nanostructures. Topics may include length scales, fabrication by top-down and bottom-up approaches, probing techniques, transport and optical properties, superconductivity and magnetism of nanostructures.

Prerequisites & Notes

PHYS 560 or PHYS 660 and PHYS 580 or PHYS 666, or consent of the department.

Course Goals and Objectives

1. Expose students to a major scientific research frontier.
2. Deepen students' understanding of solid-state physics via confinement effect and new phenomena in nanomaterials.
3. Stimulate students' interest in nanoresearch.

Student Learning Outcomes

Upon successful completion of this course the students will

1. be familiar with various nanofabrication, imaging, manipulation methods.
2. know major confinement effects and new phenomena in nanostructured materials and be able to use solid state physics to describe them.
3. be able to understand the physics in various nano-applications and nanodevices.

Instructional Methods

1) Lectures, 2) Class discussion, 3) Projects, and 4) Class presentations.

Course Assessment

Grading: Mid-term 30%; final exam 30 %; homework assignments/presentation (30 %);
Attendance and class interaction 10%

Grading scale: A ($\geq 90\%$), A⁻ (85%~89%), B⁺ (80%~ 84%), B (75%~79%),
B⁻ (70%~74%), C⁺ (65%~69%), C (55%~64%), D (40%~54%).

Class schedule (tentative)

08/24: Introduction	08/26: Nanolithographies
08/31: Self-assembly	09/02: Nano-imaging
09/07: No class (Labor Day)	09/09: Solid state physics (A)
09/14: Solid state physics (B)	09/16: Nano-superconductors (A)
09/21: Nano-superconductors (B)	09/23: Nano-superconductors (C)
09/28: Nano-superconductors (D)	09/30: Nano-superconductors (E)
10/05: Nano-superconductors (F)	10/07: Nano-superconductors (G)
10/12: Project presentations	10/14: Midterm exam
10/19: Carbon nanotubes (A)	10/21: Carbon nanotubes (B)
10/26: Graphene (A)	10/28: Graphene (B)
11/02: 2DEG	11/04: Quantum wires (A)
11/09: Quantum dots (A)	11/11: Quantum dots (B)
11/16: Quantum dots (C)	11/18: Nanophotonics
11/23: Nanophotonics	11/25: No class (Thanksgiving break)
11/30: Nanomagnetism	12/02: QuBits
12/07: Final exam	

Accessibility Statement

Northern Illinois University is committed to providing an accessible educational environment in collaboration with the Disability Resource Center (DRC). Any student requiring an academic accommodation due to a disability should let his or her faculty member know as soon as possible. Students who need academic accommodations based on the impact of a disability will be encouraged to contact the DRC if they have not done so already. The DRC is located on the 4th floor of the Health Services Building, and can be reached at 815-753-1303 (V) or drc@niu.edu.

Academic Integrity Statement

Good academic work must be based on honesty. The attempt of any student to present as his or her own work that which he or she has not produced is regarded by the faculty and administration as a serious offense. Students are considered to have cheated if they copy the work of another during an examination or turn in a paper or an assignment written, in whole or in part, by someone else. Students are guilty of plagiarism, intentional or not, if they copy material from books, magazines, or other sources without identifying and acknowledging those sources or if they paraphrase ideas from such sources without acknowledging them.

Students guilty of, or assisting others in, either cheating or plagiarism on an assignment, quiz, or examination may receive a grade of F for the course involved and may be suspended or dismissed from the university. More info can be found at <https://www.niu.edu/academic-integrity/index.shtml>.

COVID-19 Statement

Health and safety are our No. 1 priority. The Huskie community needs to protect ourselves and each other. Whenever we have in-person interaction, we'll need to be wearing a face mask. We should stay home if we've been exposed to someone who recently tested positive for COVID-19 or if we develop any symptoms that might be related to COVID-19. We should contact NIU's COVID helpline (815-753-0444) to report our symptoms and get advice. More info can be found at <https://www.niu.edu/protecting-the-pack/plan/index.shtml>.