

Solid State Physics

Bulletin Description: Crystal structure and binding, reciprocal lattices and x-ray diffraction, lattice vibrations, thermal properties, free electron model, band theory, magnetism, superconductivity.

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Lectures: T/Th 12:30-1:45 PM
South Engineering, Rm. 221

Office Hours: T/Th 2:30-3:30 PM

Text: Textbook – Solid State Physics, N. W. Ashcroft and N. D. Mermin

Goals: The goal of this course is to draw on the tools acquired in an undergraduate and graduate physics career - classical mechanics, E&M, statistical mechanics, and quantum mechanics - to solve practical and challenging problems related to the physics of ‘hard’ materials. The use of quantum theory to formulate a modern, quantitative description of the solid state is paramount, and the use of quantum-field theoretic techniques will be introduced.

Grading: Grading will be based on a combination of attendance and homework (40 %), two midterm exams (20 % each for a total of 40 %), and a final exam (20 %). The grading scale will be > 80 % (A), 70 - 80 % (B), 60 - 70 % (C), 50 - 60 % (D), < 50 % (F).

Topics:

- Week 1 (Aug. 23, 25); Drude model & Sommerfeld Theory (A&M, Ch. 1-2)
- Week 2. (Aug. 30, Sept. 1); Free electron model (A&M, Ch. 2-3)
- Week 3. (Sept. 6, 8); Crystal structure & reciprocal lattice (A&M, Ch. 4-5)
- Week 4 (Sept. 13, 15); Electrons in a periodic potential (A&M, Ch. 8-9)
- Week 5 (Sept. 20, 22); The semiclassical approach (A&M, Ch. 12-13)
- Week 6. (Sept. 27, Sept. 29); Higher-order effects (A&M, Ch. 16-17)
- Week 7 (Oct. 4, 6); Midterm I, Phonons I (A&M, Ch. 22)
- Week 8 (Oct. 11, 13); Phonons I/II (A&M, Ch. 22-23)
- Week 9 (Oct. 18, 20); Metals & Insulators (A&M, Ch. 26-27)
- Week 10 (Oct. 25, 27); Semiconductors (A&M, Ch. 28-29)
- Week 11 (Nov. 1, 3); Defects & Disorder, Midterm II (A&M, Ch. 30)
- Week 12 (Nov. 8, 10); Diamagnetism & Paramagnetism (A&M, Ch. 31)
- Week 13 (Nov. 15, 17); Magnetism I (A&M, Ch. 32)
- Week 14 (Nov. 22, TGB); Magnetism II (A&M, Ch. 33)
- Week 15 (Nov. 29, Dec. 1); Superconductivity, Modern topics (A&M, Ch. 34)
- Week 16 (Dec. 6, 8); Modern topics
- Week 17 (Final)

All work in this course must be completed in a manner consistent with [NDSU University Senate Policy, Section 335: Code of Academic Responsibility and Conduct](#).

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.

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 as soon as possible.