Physics 6001: Condensed Matter Physics II. Winter 2009.

Instructor.
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Text.
Solid State Physics. N.W. Ashcroft and N.D. Mermin. (Thomson Learning, 1976).

Other books of interest.
Condensed Matter Physics. Marder.
Magnetism in Condensed Matter. S. Blundell.
Introduction to Solid State Physics. C. Kittel.
Density Functional Theory of Atoms and Molecules. R.G. Parr and W. Yang.
Electronic Structure. R.M. Martin
Optical Properties of Solids. M. Fox.
Introduction to Superconductivity. M. Tinkham.
High-Temperature Superconductivity. G. Burns.

Evaluation.
Assignments   25%.
Topic write-up and presentation 15%
Mid-term Test 20%
Final Exam   40%.

Outline.
I. Electron-Electron Interactions (~ 3 weeks). Ch. 17 and supplementary material.
- Hartree-Fock Theory.   Correlation Energy.
- Lindhard Response Functions.
- Thomas-Fermi Theory.
- Density Functional Theory.

II. Optical Properties of Solids (~ 2 weeks). Ch. 27 and supplementary material.
- Dielectrics and Polarizability.
- Ionic Crystals.
- Interband Transitions.
- Plasmons and Excitons.

III. Magnetic Properties of Solids. (~ 4 weeks). Chs 31, 32 and 33 and supplementary material.
- Hund's Rules. Magnetic susceptibility.
- Magnetostatic interactions.
- Exchange. Anisotropy. Heisenberg Model
- Magnetic order and phase transitions.

IV. Superconductivity (~ 3 weeks). Ch 34 and supplementary material.
- Macroscopic properties and the Meissner Effect
- London Equation.
- BCS theory. Ginzburg Landau theory.
- Flux quantization.
- High Temperature Superconductors.