PHYS 8702	Syllabus	Fall 2014

Catalog Description: **PHYS 8702 – Solid State Physics (3.0 credit hours)**
Crystal and x-ray diffraction; lattice vibrations and thermal properties; energy bands and electronic properties; semiconductors; optical and dielectric properties; para-, ferro-, and antiferromagnetism; introduction to superconductivity and superfluidity.

Designation: This course is a part of the graduate curriculum in Physics.

Prerequisites: PHYS 5701 (Quantum Mechanics) and 8701 (Advanced Quantum Mechanics), or permission of the instructor.

Textbooks: N.W. Ashcroft and N.D. Mermin, *Solid State Physics* (1st edition). (Available from Temple bookstore or Amazon.)

Structure of the course: The concepts and principles underlying solid state physics will be encountered in a sequence of models or approximations, from the simplest to the most detailed and realistic. This sequence will to some extent recapitulate the history of the development of solid state physics. The power and also the limitations of the simpler models will be revealed.

Topics:

1,2. Drude classical and Sommerfeld quantum theories of metals.
3. Successes and failures of the free-electron model.
4. Crystal lattices.
5. Reciprocal lattice.
6. Determination of crystal structures by X-ray diffraction.
8. Electrons in a periodic potential.
9,10. Nearly-free electron and tight-binding methods.
12. Semiclassical model of electron dynamics.
14. Fermi surface.
22. Classical theory of the harmonic crystal.
23. Quantum theory of the harmonic crystal.
28,29. Semiconductors.
34. Superconductivity.

Students are encouraged to ask and answer questions in class. The topics covered, and the level of coverage, can be adjusted in response to class feedback.

Class Schedule: TR 3:30-4:50 Barton Hall Classrooms 405

Schedule: midterm exam Tuesday, October 14
final exam Thursday, December 11, 1:00-3:00 (~1/3 on material before the midterm, and 2/3 on material after the midterm)

Grades: homework 20%, midterm exam 35%, final exam 45%

Instructor: Professor John P. Perdew, Barton Hall A 407 or SERC 720, perdew@temple.edu
Office hours Tuesdays 2:00-3:00 or as announced