Syllabus: Atomic, Molecular and Condensed Matter Physics
Phy491, Fall 2011

Credits: Total Credits: 3

Prerequisites: (PHY 471 and PHY 410) and completion of Tier I writing requirement

Description: Many-electron atoms, Molecules, Crystal structure, Lattice dynamics, Band models of metals and semiconductors, Electronic properties.

INSTRUCTOR: S. D. Mahanti, room 4269 Biomedical & Physical Sciences, Telephone: 884-5633 Email: mahanti@pa.msu.edu. Office hours: Tuesdays: 10:30am-12:30am. Call or email to schedule an appointment at other times.

Text: Textbook: C. Kittel, Introduction to Solid State Physics (7th or 8th edition). Additional reading from other books and some review papers will be recommended during the lectures.

Course Structure: 3 meetings per week on Monday, Wednesday and Friday: 1:50pm to 2:40pm. Room 1415 BPS Building.

The schedule of the lectures is attached

Topics:

PART I (Atomic and Molecular Physics) Review of Hydrogen atom; Different units; Excitons and other hydrogenic systems; Variational approach; Relativistic Effects; Many electron atoms and the Periodic Table; Hund's rules; Magnetic properties of atoms; Diamagnetism; Paramagnetism; Born-Oppenheimer approximation; H_2^+ molecule; Molecular orbitals; Hund-Mulliken and Heitler-London for H_2; Electronic configuration of diatomic molecules.

PART II (Solid State Physics): Crystal Lattices, Bravais Lattices; Lattices with basis; Wigner Seitz unit cells; Reciprocal Lattice; Brillouin Zone; X-Ray and Electron Diffraction; Ewald's construction; Structure Factors; Bloch's theorem; Crystal Momentum; Band structure; Metals, Semiconductors, and insulators; Properties of Nearly free electrons; Tight binding model; Density of states; Classical Harmonic Crystal; Quantum Harmonic Crystal; Einstein

and Debye Models for specific Heat; Electronic properties (Thermal, Magnetic, Transport, Optical)

Homepage: http://www.pa.msu.edu/courses/current/PHY491/

Grading:

Individual Homework (HW): Homework problems will be assigned during the semester. There will be no credit for the homework – solutions will be posted. You should solve the HW problems because **50% of the exam questions will be taken from these assignments.**

Midterm Exams: There will be two midterm exams (1 hour duration), on **Monday October 3** and **Monday November 7** during the class hour.

Final Exam: Final exam will be held on Monday December 12, 12:45-2:45 p.m. (BPS 1415)

Final Grades: Grades are based on the following formula:

	%
First Midterm	25
Second Midterm	25
Final	50
TOTAL	100

The guaranteed scale may be lowered in your favor but not raised is:

Total point percentage	Final grade
>85%	4.0
76%-85%	3.5
66%-75%	3.0
56%-65%	2.5
46%-55%	2.0
37%-45%	1.5
30%-37%	1.0
<30%	0.0