

**Winter 2013            PHY 5015 Non-Classical Physics for Secondary School Educators**

**Lecture Hours:**    M 5 - 8 PM  
**Location:**            219 Physics

**Lecturer:**        Karur R. Padmanabhan  
Office: Rm.364 Physics Building  
Telephone: 313- 577-3005  
E-mail: ad2639@wayne.edu  
Office Hours: M 4 -5 PM  
                              T, Th 4 - 6.30 PM

**Course Objective:** To develop conceptual understanding and problem solving Skills in Modern Physics  
All information, problems, assignments will be posted on Blackboard

**Text Book:**            Most of the topics listed below will follow Chapters 26- 30 in College Physics by Serway and Faughn 5<sup>th</sup> or 7<sup>th</sup> edition. Some copies are available. Please wait until first day of class before buying this book.

**Home work:**            Weekly home work will be assigned. These need to be submitted at the beginning of class the following week.

**TENTATIVE SCHEDULE**

<b>Date</b>	<b>Topic</b>
1/7	Review of classical Physics, What is Modern Physics, Maxwell's equation, EM waves and properties,
1/14	Black body radiation, energy, Plank's hypothesis, particle theory of light, photoelectric effect.
1/21	University Closed.
1/28	X-rays, X-ray diffraction, photons, The Compton Effect, matter waves, wave- particle duality, the wave function, de Broglie waves uncertainty principle, applications and implications of quantum theory
2/04	Model of the atom, atomic spectra, Bohr model, modifications, hydrogen atom wave function, quantum mechanics of hydrogen atom, quantum numbers.
2/11	Multi electron atoms, electron cloud, Pauli's exclusion principle, excited states and spectra, characteristic X-rays, atomic transitions. Lasers.

2/18 **Exam-1 ( one hour)**

Hydrogen molecule, covalent bond, ionic bonding, molecular vibrations and rotations, molecular spectra.

2/25 Ionic and covalent solids, energy bands in solids, intrinsic and extrinsic semiconductors, semiconductor devices and superconductivity.

3/04 Properties of Nucleus, nuclear Structure and stability, BE, radioactivity, radioactive decay processes,

**3/11 No Class- Spring Break**

3/18 **Exam-2 (one hour)**

Nuclear reactions, radiology and other nuclear medical applications. nuclear fission, reactors, nuclear Fusion.

3/25 Fundamental forces of nature., elementary particles, anti particles, families of particles, conservations laws. Quark and standard models.

4/01 Relativity, introduction to Galilean Relativity, Michelson Morley Expt. and speed of Light, Einstein's special theory of relativity, Length, time and mass - relativistic velocities, momentum and energy.

4/08 Relativity (cont), introduction to general relativity, pair production and annihilation, the cosmic connection.

4/15 Ultimate building blocks of matter, astrophysics (neutron stars, black holes), the cosmic connection.

4/22 Review

**4/29 Final Exam ( 5-7.30 PM in 219 Physics)**

Grades in this course will be determined by your performance on the exams, assigned homework problems.

**Lab:** There is no lab component for the course. However, the course may include participation in some lab/demos such as photoelectric effect, Radioactivity etc. These will be announced in class. Participation is not mandatory. Those who wish to enroll in a lab can register for PHY 3310 (Modern Physics Lab) after discussing it with instructor.

Exams: There will 2 mid term and one final exam.

Homework	25%
First Exam	20 %

Second Exam  
Final Exam

20 %  
35 %