Basic information:

1. Course Description (課程說明)

This course will introduce students to two pillars of modern physics: Quantum Physics and Einstein's Special Theory of Relativity. Both of them discovered during the first 25 years of the twentieth century. The first, quantum theory, was the work of many physicists, including Bohr, Einstein, Heisenberg, Schrodinger, and others. Just as relativity can be roughly characterized as the study of phenomena involving high speeds, so quantum theory can be described as the study of phenomena involving small objects (e.g., atomic size or smaller). It thereby provides concepts for understanding the microscopic world. Students will learn basic principles of quantum mechanics, such as the wave-particle duality, the uncertainty principle, and working equation (Schrodinger equation) for its application in a variety of simple application, such as Energy Levels of Electrons in a Solid, Semiconductors, The *pn* junction Diode, atom, molecules and others. The second, relativity was first proposed by Albert Einstein. It provides a precise and well-tested description of nature for motions at or near the limiting speed of light. Student will learn basic principles and concepts of relativity and will develop physical intuition for high speed physical phenomena. The second,

近代物理這門課將介紹兩個重要課題：(狹義)相對論和量子物理，這兩個物理學觀念是二十世紀初期建立發展出來的，第一要介紹的重要物理觀念是量子物理，這個理論是二十世紀初期，波爾、愛因斯坦、海森堡、薛丁格、和其他物理學家架構起來的，這個理論解釋了微小世界的物理現象(量子或是更小尺寸等級物理)，學生將在這堂可中學習量子的觀念、波粒兩向性、測不准原理、薛丁格方程式和在量子物理在固態、半導體、原子、分子上的延伸應用。第二個重要觀念是，相對論，愛因斯坦是第一個位提出相對論的物理學家，他解釋了物體在超高速移動下（接近光速下），不同座標系上的物理量關係，這個理論的準確性已經經過一個世紀的驗證。學生在這門課將學習到相對論的基本概念。

2. Text Books (指定用書)

Modern Physics, third edition/ Serway, Moses, and Moyer

3. References (參考書籍)

1. Introduction to Quantum Mechanics/ David J. Griffiths
2. Modern Physics for Scientists and Engineers, 2nd ed. J. Taylor, C. D. Zafirators, M. Dubson
3. Quantum Mechanics – concepts and Applications/ Nouredine Zettili

4. Teaching Method (教學方式)

Slides presentation and blackboard writing

5. Syllabus (教學進度)

- **Quantum Physics (11 weeks)**
    - Problems with classical physics
        - blackbody radiation
        - photoelectric effect
        - Compton effect
        - atomic spectra and stability of matter
        - double-slit experiment
    - "Old" quantum physics
        - De Broglie's matter waves
        - Bohr model of Hydrogen atom
    - Schrodinger equation
        - postulates and interpretation
        - stationary eigenstates
        - nature of solutions
    - Simple problems in one dimension
        - free particle
        - particle in box
        - particle in a harmonic potential
        - tunneling
    - Problems in two and three dimensions
        - square box
        - harmonic oscillator
        - central-force problem
        - Hydrogen atom
- **Applications (2 weeks or optional)**
    - Energy Levels of Electrons in a Solid; Bands
    - Semiconductors
    - The *pn* junction Diode
    - The Scanning Tunneling Microscope
- **Relativity (2 weeks)**
    - principles of relativity
    - Galilean relativity
    - constancy of speed of light
    - relativity of time
    - relativity of length
    - Lorentz transformations
    - velocity transformation
    - Doppler effect

- mass
- momentum
- energy

6. Evaluation (成績考核)

Homework assignments and due dates will be announced in class. 10-minute quizzes will be on random dates and will be announced at the beginning of class.

Grading method:

Homework and quizzes 30%

Midterm 20% each

Final 30%

7. 2013 EE211000 webpage (網頁位址)

http://mx.nthu.edu.tw/~mingchang/