**PHYSICS 3300: Introduction to Modern Physics:**

**COURSE OUTLINE: WINTER 2014**

Room 177, Physics Building, MWF, 12:50 – 1:45 p.m.

LECTURER: P. H. Keyes OFFICE: Room 239, Physics Building, PHONE: 577-2606

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OFFICE HOURS: M. and W., 4-5 p.m.; and by appointment.

TEXT: *Modern Physics for Scientists and Engineers*, Thornton and Rex, **3rd edition**, ISBN 0-534-41781-7

**Readings**

The single most important thing that you as a student can do to obtain a good understanding and hence a good grade is to read and reread the text until comprehension is obtained. The lectures can help toward this goal, but they are not by themselves sufficient. For one thing, there is simply not enough time in the lectures to cover the material with as much thoroughness as the text does. Also, class time should ideally be used as much as possible for the discussion of the topics that you have already read about. So *please read the textbook!* We will cover chapters 1 – 8 and 12 – 16.

**Homework assignments**

A few problems from the text will be assigned each week and will be collected one week later. At that time solutions will be posted in the glass case on the second floor of the Physics building. Thereafter no late homework will be accepted. Your homework will be marked on a scale with two points being given for each complete and correct answer and one point for each reasonable attempt. No credit will be given for minimal efforts or for work that is obviously copied from another student.

**Exams and grading**

Your grade in the course will be determined by your performance on the homework, the three hourly exams, and the final exam:

Homework 1 unit

First Hourly Examination 1 unit

Second Hourly Examination 1 unit

Third Hourly Examination 1 unit

Final Examination 2 units

TOTAL 6 units

The final exam will cover all the material of this course; however, there will be slightly more emphasis on material not covered by the three hourly exams.

**Grading Scale**: A/A-: 80%-100%; B+/B/B-: 70%-80%; C+/C/C-: 60%-70%; D+/D/D-: 50%-60%; E 0%-50%.

## In-class policies

Out of consideration for the other students in the lecture please abide by the following rules of conduct: (1) Turn off all cell phones while in lecture, (2) Please arrive on time for lecture and do not leave early, (3) Please be mindful of your classmates.

## Academic dishonesty

All of the graded assignments are designed to measure your individual understanding of the material. No forms of cheating on these graded assignments will be tolerated (working together on the homework assignments is not considered cheating, but copying of someone else’s homework is). Anyone found cheating on any graded activity will receive a grade of zero for that part of their grade, and may receive a failing grade for the course. *Students who cheat on an exam will receive a failing grade for the course*. Use of a cell phone during an exam will be regarded as evidence of cheating.

## Pre-requisites and co-requisites

This course requires PHY2180 as a pre-requisite. Physics majors must also take PHY3310 as a co-requisite.

**Adding & withdrawing**

This semester Wednesday, September 4 is the last day a course may be added and Saturday, November 9 is the last day you may withdraw from a course.

## Students with disabilities

If you have a documented disability that requires accommodations, you will need to register with Student Disability Services for coordination of your academic accommodations. The Student Disability Services (SDS) office is located at 1600 David Adamany Undergraduate Library in the Student Academic Success Services department. SDS telephone number is 313-577-1851 or 313-577-3365 (TDD only). Once you have your accommodations in place, I will be glad to meet with you privately during my office hours to discuss your special needs. Student Disability Services’ mission is to assist the university in creating an accessible community where students with disabilities have an equal opportunity to fully participate in their educational experience at Wayne State University.

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**For physics majors and others taking PHY3310 (lab sec.): Room 115, Phys. Bldg., Mon. 1:55-3:55 pm**

PHY3300/3310 is one of the courses used to meet the university requirements for our physics majors to have courses that require/teach computer literacy. To satisfy the computer requirement the first meeting will be a “computer lab,” and all subsequent labs will use the computer for processing, analyzing and plotting the data.

The lab descriptions will be given out by email at the beginning of the course. You should check the lab schedule on the next page and make sure that you are familiar with the setup of each lab well in advance of coming to class. You will be expected to obtain your final results and answer all the questions *by the end of the lab session.* Your grade will be based to a large extent by your in-lab performance. There will also be a mid-term lab exam and a final lab exam.

DATE TOPIC LAB(Mon.)/HW Due(Wed.)

1/6 Introduction, E=mc2, Michelson-Morley Experiment

1/8 Covariance, Galilean Transformations

1/10 Simultaneity, Einstein’s Postulates

1/13 The Lorentz Transformations, Velocity Addition Linear regression with a Spreadsheet

1/15 Time Dilation, Length Contraction HW1

1/17 Relativistic Energy and Momentum

1/20 Holiday – no class

1/22 Evidence for Atoms, Kinetic Theory, Brownian Motion HW2

1/24 The Discovery of the Electron, Mass Spectrometers

1/27 Millikan's Determination of the Electron's Charge Michelson interferometer

1/29 Blackbody Radiation HW3

1/31 Planck's Formula and the Quantum Hypothesis

2/3 **Exam I**

2/5 The Photoelectric Effect and the Photon Hypothesis

2/7 X-rays, Bragg Diffraction, Pair Production

2/10 The Compton Effect, Wave-Particle Duality Stefan-Boltzmann law

2/12 Rutherford Scattering, the Nuclear Atom HW4

2/14 Atomic Spectra, The Bohr Atom, Hydrogen-like Atoms

2/17 The de Broglie Wavelength, Electron Diffraction photoelectric effect

2/19 The Uncertainty Principle, Born's Probabilistic Interpretation HW5

2/21 Wave Function for a Free Particle, Schrödinger's Equation

2/24 Potential Wells, Particle in a Box microwave diffraction

2/26 Simple Harmonic Oscillator, Tunneling HW6

2/28 Particle in a Three-dimensional Box, Degeneracy, Central Forces and Angular Momentum

3/3 **Exam II**

3/5 The Zeeman Effect, Space Quantization

3/7 Spin, Spin-Orbit Interaction

3/17 The Quantum Mechanical Atom, The Exclusion Principle electron diffraction

3/19 The Periodic Table, Moseley's Law HW7

3/21 Properties of the Nucleus

3/24 The Strong Force, Nuclear Models Franck-Hertz experiment

3/26 Nuclear Radiation, Radioactivity HW8

3/28 Theory of Alpha Decay

3/31 Nuclear Reactions spectrograph-Balmer series

4/2 Fusion and Fission, Chain Reactions HW9

4/4 Nuclear Reactors

4/7 **Exam III**

4/9 Families of Particles, the Fundamental Interactions

4/11 Particle Interactions and Decays, Conservation Laws

4/14 The Quark Model nuclear decay

4/16 The Standard Model of Particle Physics HW10

4/18 General Relativity

4/21 Cosmology

4/22 Cosmology

4/28 **Final Exam** – Monday, 10:40 – 1:10