January 2009

# Physics 131 – General Physics I (4)
# (Also listed as HNRS 131)
# Course Outline GE B3 & B4

**Prerequisites for Phys 131** are Math 141 with grade C- or better and Math 142 or Math 182 (or concurrent enrollment). Since the course is calculus based, the students are expected to be able to differentiate and know how to solve some basic integrals. Recommended: High school physics. For **ME and AERO students only**. (Other students cannot register for this course.)

**Learning Objectives and Criteria:**
Upon completion of the course the student is expected to:

a: Know that the physical world can be described in terms of mathematics.
b: Apply the laws of conservation of energy and conservation of momentum.
c: Know that most scientific theories can be tested in the laboratory.
d: Solve problems in an organized and systematic way using free body diagrams.
e: Know that real world problems are often complex and have no exact solutions.
f: Know that physics is able to explain many of the natural phenomena.
g: Know that an understanding of the laws of physics is needed in all scientific disciplines.

**Text and References:**
Young and Freedman, University Physics, 12th edition, Pearson Addison Wesley, 2008.

Physics 131 is the first of a calculus-based, 3-course sequence: Phys 131, 132, 133. It is a required course for mechanical engineering and aeronautical engineering majors. It introduces the students to the basic ideas in physics, such as conservation of energy and conservation of momentum as well as Newton's laws. A substantial part of the course is devoted to teaching students how to solve problems in a structured way and helping students realize that most problems in science and engineering can be explained in terms of the logic of mathematics and physics. The course provides a stepping-stone to further studies in more advanced courses both in physics and related disciplines.

**Content and Method:**

**Method: Physics 131 is offered in a traditional lecture/lab format**. It meets a total of 6 hours a week – 3 hours of lecture and one 3-hour lab

**Content: Physics 131 will adhere to the following topics:**

- Introduction to units of measurements, definitions of positions, displacement, velocity, and acceleration.
- One dimensional kinematics, vectors and scalars.
- Two or three dimensional kinematics, projectile motion and circular motion.
- Newton's laws of motion, force and weight, applications of Newton's Second Law.
- More applications of Newton's second law, static and sliding friction.
- Work and energy, definition of power.
- Conservation of mechanical energy.
- Systems of particles, center of mass, velocity of center of mass, acceleration of center of mass and momentum.

- Conservation of momentum in collisions, rotational mechanics.
- Moment of inertia, angular momentum and applications of rotational motion.

**Lab Sections:**

The multiple sections of the course all do the same experiment in a given week. Usually the students will perform 10 experiments in a given quarter. The students typically work in groups of three at each of the 8 stations, limiting the class size to 24. The students will spend most of the 3-hour period collecting and analyzing data. They will then be required to analyze their data and discuss their results in a written and/or oral report. In a typical quarter, the students will do the following experiments:

- Data taking and analysis
- Linear acceleration
- Equilibrium produced by forces
- Coefficient of sliding friction
- Centripetal force
- Conservation of energy
- Elastic potential energy
- Momentum conservation
- Ballistic pendulum
- Moment of inertia

To ensure uniformity as much as possible, the instructor in charge of the course provides the syllabus for all instructors involved in the course. The syllabus outlines the chapters and topics to be covered for a given week as well as the homework assignments for that particular week. All students in the various sections will do the same laboratory experiment scheduled for that particular week.

**Methods of Assessment:**

**Lecture/Lab Sections:** The methods of assessment, in order of importance, are: Exams (2 or 3 one-hour exams and a final exam); Weekly homework assignments; Quizzes; Laboratory reports.