JP001: Inquiry-Based Physics

Course Description

JP001 is a one-year inquiry based physics course covering the elements of Newtonian physics and elements of electricity & magnetism. Being an inquiry-based course, JP001 will primarily involve students' exploration of basic principles of physics. Throughout this process various skills will be enhanced (see below under Learning Objectives). In addition, certain key skills to succeed in further physics and other science courses will be developed. These include, but are not limited to, multidimensional representation of phenomena, graphical analysis, uncertainty analyses, and modeling physical phenomena in more than one way. These objectives and skills should allow the student to easily succeed when proceeding on to more advanced, calculus-based, presentations of physics.

Course Objectives

Learning objectives:

- Ability to design and conduct an experiment to explore a basic physics principle or law.
- Identify questions and concepts that guide investigation.
- Recognize and analyze alternative explanations and models.
- Communicate and defend a scientific argument. Emphasis on applying basic principles of logic.
- Analyze complex and/or poorly defined problems or that are not communicated well. (Not simply confined to well-defined word problems often found in textbooks.)
- Work in groups and communicate well.
- Develop multiple explanations of effects.
- Learn process to carefully observe, record, and analyze new, potentially unfamiliar phenomena.
- Learn to distill fundamental parameters of observations; develop (conceptual) models of observations; and test for correctness of proposed models.

Specific goals:

- Represent data in various formats (graphical, tabular, etc.).
- Interpret graphical evidence.
- Understand the independence of motion in perpendicular directions.
- Understand kinematics in multiple representations (graphical, vector, algebraic).
- Translate observed motions to abstract representations (and vice versa).

Course Schedule

Fall Semester:

- What is physics?
- Fundamental entities and properties.
- Measuring properties of objects and systems.
- Characteristic properties of substances.
- Measuring changes of properties in time.
• Define rules relating to changes of state (kinematics).
• Deduction, prediction, and verification by experiment

**Spring Semester:**
• Having understood the process, now apply to new/unfamiliar systems.
• Newton's three laws of motion.
• What remains the same? Conservation principles (energy and momentum).
• Further explorations in physics (structure of matter, Standard Model).

**Required Text**
*Head First Physics: A learner's companion to mechanics and practical physics*
Lang, Heather
O'Reilly, 2008.

**Key Assignments**
Each semester, the final letter grade will be determined through the following types of assignments:
• **Class Participation:** Students are expected to participate in in-class discussions and be part of an active learning environment. This portion of the grade will be determined based on attendance and regular participation in the discussion.
• **Assignments:** Students will periodically complete question sets and short writing assignments.
• **Experiments:** Students will maintain a well-organized and detailed lab notebook (or science journal) for each experiment.
• **Quiz:** There will be quizzes each semester testing students' mastery of each major segment of the course.
• **Final Exam:** There will be a comprehensive, written, proctored final exam each semester.