Course Information

**Catalog description:** Students will be taught how to numerically solve ordinary differential equations using 4th order techniques such as Runge-Kutta and Adams-Bashforth-Moulton in the Python programming language. These techniques will be used to solve diverse physics problems not amenable to simple analytical solution, such as n-body gravitational motion, the motion of charged particles in a magnetic bottle, the behavior of a car's suspension on a bumpy road. Emphasis is placed on physically accurate modeling (e.g. satisfying conservation laws to high accuracy) and the effective use of computer graphics/animation for the presentation of results. Students need not have significant programming experience for this course.

Topics include: implementation of fourth-order Runge-Kutta and Adams-Bashforth-Moulton, Fourier transforms, Stochastic processes and Monte Carlo simulations as well as appropriate techniques for visualization/animation of simulation results.

The course will be structured as a series of physics problems such as rigid body collisions, physics of roller coasters, car suspension simulation, chaotic solar systems, that will require accurate and detailed physical and mathematical modeling. The final project will be an advanced application determined by the student in consultation with the instructor and can cover topics ranging from advanced molecular dynamics to biophysics modeling.

This syllabus contains the policies and expectations set for Ph 235. Please read the entire syllabus carefully before continuing in this course. These policies and expectations are intended to create a productive learning atmosphere for all students. Unless you are prepared to abide by these policies and expectations, you risk losing the opportunity to participate further in the course.

**Prerequisite:** CS102, Ph112, Ma113, and permission of instructor

**Meeting Time and Location:** Mondays: 2-4pm; Wednesday: noon-1pm Physics Lab NAB 301

**Credit:** 3 units This 3-credit course requires 3 hours of classroom or direct faculty instruction and on average 2-6 hours of out-of-class student work each week for approximately 15 weeks. Out-of-class work may include but is not limited to: Required Reading, Coding assignments, Written assignments, and studying for quizzes and exams.

**Optional Text Books:**
- *Computational Physics with Python - Mark Newman* (Several chapters are online) [URL: http://www-personal.umich.edu/~mejn/computational-physics/]
- Additional Readings will be provided as handouts.
Instructor: Anita Raja  Email: araja@cooper.edu  Phone: 212-353-4309  http://engfac.cooper.edu/araja

Office hours:  Mondays 1-2pm, Wednesdays 10-noon or by appointment,

WebSite:

• Participants can access the course web site by logging into moodle.
• Course notes will available only through Moodle.
• All assignments have to be submitted using Moodle, without exception.
• Students are responsible for monitoring the Moodle site and message boards on a regular basis.

Grading Schema:

• In-class Participation/Online quizzes/Surveys  5%
• 1 Midterm Exam  20%
• Assignments (5-6)  35%
• Final Project  40%

Policies:

Several of the following policies have been mandated by the University for compliance with new federal regulations and SACS accreditation standards.

• There will be reading assignments for each week and will be specified in the syllabus.
• All assignments should be submitted using Moodle.
• Assignments should be submitted by **11:30pm** on the due date. Late submissions upto 3 days (beyond the due date specified by the assignment) will be automatically allowed on Moodle. **Late submissions will result in a 10% penalty per day for up to 3 days and then it is a 0 on that assignment - no exceptions will be made.**
• Copying assignments from other teams/ individuals will result in an F for all parties involved. All open source code that is used should be appropriately acknowledged. Please read the section on Academic Standards and Regulations found in the Course Catalog. Feel free to talk to me if you have questions whether an action would violate the integrity code.
• Please arrive in class on time.
• The standards and requirements set forth in this syllabus may be modified at any time. Notice of such changes will be by announcement in class or by changes to this syllabus posted on the course website.
• Students with disabilities or who need special accommodations for this class are required to meet with me and the Dean of Students immediately so that arrangements can be made. Cooper Union has limited resources and extra time is required for such arrangements to be feasible. In order to receive accommodations for an exam, you must notify me in writing at least two weeks before they are needed, and you must also be registered with the Dean of Students. Students will not be afforded any special accommodations retroactively, i.e., for academic work completed prior to disclosure of the disability to me and the Dean.

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