

PHY 277 Computation for Physics and Astronomy Majors

Instructor: Prof. Marivi Fernandez-Serra (maria.fernandez-serra at stonybrook.edu)

Office: **Physics B-139**; office hours: **At Sinc Site Fridays 11:00-12:00 am ; In B-139 Th 10:00-11:00 am or by appointment.**

TA: Abhishodh Prakash abhishodh a gmail.com

Office Hours: Sinc Site TBA

The class will meet in the Math SINC Site Room SL-235 (in the Sub-level of the MATH Tower) , MWF 10:00-10:53 am

Scope of the Course

This course is designed to provide sophomore Physics and Astronomy majors with computational resources and algorithmic thinking. Computational physics has become the third cornerstone of modern physics, sitting in between experimental and theoretical physics and serving as a bridge in between and complement to both of these areas. the purpose of this course is to introduce students to algorithmic programming. We will do this in matlab and fortran. The course aims to provide students with computational resources in order to make the numerical solution of physics problems a natural and alternative way to the analytical methods that students learn throughout their majors.

The course will focus on developing the skills needed carry out core tasks on modern computers running linux or Unix-based operating systems. This course will cover the following core topics:

Introduction to software and programming language (Matlab/GnuOctave). Essential Concepts. Command Line. Elementary Functions. Variables. Vectors. Vector Operations. Vectorization. Graphic function representation. Scripts. Physics Applications: Description and representation, single particle motion. Trajectories: $r(t)$, $v(t)$, $a(t)$. Elemental numerical derivation. Velocity and Acceleration. Elementary integration.

Matrices. Matrix Operations. Functions. Loops and control structures. Function interpolation. Graphics of surfaces. Physics applications: Rotation matrices. Function potential of a charge. Representation of vector and scalar fields.

System of Linear Equations. Roots of a function. Finding Max and Min. Physics applications: Conservation of energy and momenta in collisions. Solution of the equations of an electric circuit. Relaxing a system of springs to its minimum (equilibrium).

Basic concepts of statistics and probability applied to experimental data analysis. Least squared fitting. Physics Applications: Representation and analysis of experimental data. Mean values and error analysis. Phenomenological modeling.

Integration of Newton's equations of motion Physics applications: Equations of motion with initial conditions. Modeling of physical systems

Using Unix-based computer systems running X-windows.

The core of the course will be dedicated to learn Matlab programming language.

Essentials on Fortran programming language.

In complement to the programming language learning we will also focus on :

Elementary numerical methods.

An introduction to the LaTeX typesetting system.

A brief outline for each lecture will be published on this web page before each lecture.

The programming assignments will be graded on the basis of accuracy, completeness,

originality and programming style.

What to Expect

This course will require you to carry out numerous programming or other computing tasks on the MATHLAB linux machines located in S235 of the math tower. It is likely you will have to spend a substantial amount of time writing and debugging programs in

this laboratory setting. It may be possible in some cases for you to carry out some assignments on other computers however the Instructor and Teaching Assistants for this

course will not offer any formal support for such efforts. The bottom line is that you should plan to carry out your work on the MATHLAB machines or other machines specified by the instructor. The instructor may require you to turn in your assignments

electronically, via web pages that you develop, or in the form of hardcopy. The course

T.A. will hold office hours in the MATHLAB in order to assist you with problems that you may encounter in carrying out your assignments. Lecture outlines will be provided

via the course web site.

Required Texts

https://stonybrook.amazon.com/NUMERICAL-METHODS-Steven-Chapra/dp/1308965087/ref=sr_1_1?ie=UTF8&qid=1484139031&sr=8-1&keywords=9781308965086

Course section: <http://connect.mheducation.com/class/phy277-spring17>

Course Grading

This course requires important continuous work and dedication. The majority of the grade weight in this course will be put on the homework assignments rather than on the

exams. If you work on these assignments and finish them on time every week you will

certainly pass the course without problems.

There will be two midterms and a final exam. The grading policy will be:

Assignments : 30 %

Midterm 1: Feb 24 20%

Midterm 2: Apr 14 20 %

Final: Last week of class 30 %

Teaching Assistant

The course T.A. will hold office hours in the MATHLAB in order to assist you with problems that you may encounter in carrying out your assignments. Lecture outlines will be provided via the course web site.

Attendance.

As per the University policy outlined in the Undergraduate Student Bulletin, students are expected to regularly attend all classes.

Assignments

All work on class assignments is to be carried out independently, but collaboration is allowed, as long as this helps students to learn. However, all submitted computer programs and assignments should be written by you alone. If you work together with a friend, do not submit two identical codes. Late assignments will be accepted, with a 20% reduction of the grade for each day of delay.

Computer Use.

All use of University owned computers and networks must be in accordance with the University Information Technology Policy.

Passwords.

You are responsible for maintaining your MATHLAB computer account password. Lost or forgotten passwords will under no circumstances be accepted as an excuse for turning in homework assignments. If you loose or forget your password your password the instructor is unable to reset it for you. Your only recourse for a lost or forgotten password is to appeal for help from the MATHLAB administrator at help@mathlab.sunysb.edu

Classroom Behavior and Conduct. You are expected to conduct yourself in accordance with the minimal undergraduate student responsibilities described in the Undergraduate Student Bulletin including: You are expected to arrive for class promptly. Avoid behavior that is disruptive to the classroom especially the use of cell phones. Web surfing during class, unless required is prohibited.

Lecturer contact information: Prof. Marivi Fernandez-Serra
e-mail: mvfernandezs@ms.cc.sunysb.edu

IMPORTANT UNIVERSITY POLICIES

ELECTRONIC COMMUNICATION

Email to your University email account is an important way of communicating with you for this course. For most students the email address is 'firstname.lastname@stonybrook.edu', and the account can be accessed here: <http://www.stonybrook.edu/mycloud>.

It is your responsibility to read your email received at this account.

For instructions about how to verify your University email address see this: <http://it.stonybrook.edu/help/kb/checking-or-changing-your-mail-forwarding-address-in-the-epo> . You can set up email forwarding using instructions here: <http://it.stonybrook.edu/help/kb/setting-up-mail-forwarding-in-google-mail> .

If you choose to forward your University email to another account, I am not responsible for any undeliverable messages.

Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Any suspected instance of academic dishonesty will be reported to the Academic Judiciary. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website.

SPECIAL NOTE REGARDING PLAGIARISM AND DISHONESTY: All instances of plagiarized work or academic dishonesty will be brought before the Academic Judiciary Committee. All parties involved (both the copier and the person who produced the original work) will be held accountable for any instance of plagiarism or dishonesty.

ACADEMIC INTEGRITY

Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Any suspected instance of academic dishonesty will be reported to the Academic Judiciary. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website at <http://www.stonybrook.edu/uaa/academicjudiciary/>

RELIGIOUS OBSERVANCES

See the policy statement regarding religious holidays at <http://www.stonybrook.edu/registrar/forms/RelHolPol%20081612%20cr.pdf>. Students are expected to notify me by email of their intention to take time out for religious

observance. This should be done as soon as possible but definitely before the end of the 'add/drop' period. At that time they can discuss with me how they will be able to make up the work covered.

DISABILITIES

If you have a physical, psychiatric/emotional, medical or learning disability that may impact on your ability to carry out assigned course work, you should contact the staff in the Disability Support Services office [DSS], 632-6748/9. DSS will review your concerns and determine, with you, what accommodations are necessary and appropriate. All information and documentation of disability is confidential.

Students who require assistance during emergency evacuation are encouraged to discuss their needs with me and Disability Support Services. For procedures and information go to the website <http://www.sunysb.edu/ehs/fire/disabilities.shtml>

CRITICAL INCIDENT MANAGEMENT

Stony Brook University expects students to respect the rights, privileges, and property of other people. I am required to report to the University Police and the Office of University Community Standards any serious disruptive behavior that interrupts teaching, compromises the safety of the learning environment, and/or inhibits students' ability to learn. See more

here: <http://www.stonybrook.edu/sb/behavior.shtml>