



ISC 3313

Introduction to Scientific Computing

Time/Location TBD

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Dirac Science Library 432D
Office Hours: TBD

Course Description: This course (3 credit hours) introduces the student to the science of computations. Topics cover algorithms for standard problems in computational science, as well as the basics of an object-oriented programming language, to facilitate the students' implementation of algorithms. The programming language depends on the semester. This semester the language will be Python.

Prerequisite: MAC 2311

Note: This course satisfies the Computer Skills Competency requirement.

Credit Hours: 3

Text: *Object-Oriented Programming in Python* by M. Goldwasser and D. Letscher
Available for free online: <http://cs.slu.edu/~goldwamh/oopp>

Course Objectives:

- identify the components of scientific computing
- identify standard problems in scientific computing
- describe algorithms for standard problems in computational science
- implement algorithms as computer programs
- present results as printed text, data files or graphic illustrations/animations

Grade Distribution:

Quizzes	30%
Assignments	30%
Capstone Project	40%

Computer Competency Requirement:

In order to fulfill FSUs Computer Competency Requirement, the student must earn a C- or better in the course, and in order to receive a C- or better in the course, the student must earn at least a C- on the computer competency component of the course. If the student does not earn a C- or better on the computer competency component of the course, the student will not earn an overall grade of C- or better in the course, no matter how well the student performs in the remaining portion of the course.

University Attendance Policy:

Excused absences include documented illness, deaths in the family and other documented crises, call to active military duty or jury duty, religious holy days, and official University activities. These absences will be accommodated in a way that does not arbitrarily penalize students who have a valid excuse. Consideration will also be given to students whose dependent children experience serious illness.

Academic Honor Policy:

The Florida State University Academic Honor Policy outlines the University's expectations for the integrity of students academic work, the procedures for resolving alleged violations of those expectations, and the rights and responsibilities of students and faculty members throughout the process. Students are responsible for reading the Academic Honor Policy and for living up to their pledge to . . . be honest and truthful and . . . [to] strive for personal and institutional integrity at Florida State University. (Florida State University Academic Honor Policy, found at <http://fda.fsu.edu/Academics/Academic-Honor-Policy>.)

Americans With Disabilities Act:

Students with disabilities needing academic accommodation should: (1) register with and provide documentation to the Student Disability Resource Center; and (2) bring a letter to the instructor indicating the need for accommodation and what type. This should be done during the first week of class. This syllabus and other class materials are available in alternative format upon request. For more information about services available to FSU students with disabilities, contact the:

Student Disability Resource Center

874 Traditions Way

108 Student Services Building

Florida State University

Tallahassee, FL 32306-4167

(850) 644-9566 (voice)

(850) 644-8504 (TDD)

sdrc@admin.fsu.edu

<http://www.disabilitycenter.fsu.edu>

Free Tutoring from FSU:

On-campus tutoring and writing assistance are available for many courses at Florida State University. For more information, visit the Academic Center for Excellence (ACE) Tutoring Services comprehensive list of on-campus tutoring options - see <http://ace.fsu.edu/tutoring> or contact tutor@fsu.edu. High-quality tutoring is available by appointment and

on a walk-in basis. These services are offered by tutors trained to encourage the highest level of individual academic success while upholding personal academic integrity.

Syllabus Change Policy:

Except for changes that substantially affect implementation of the evaluation (grading) statement, this syllabus is a guide for the course and is subject to change with advance notice.

Tentative Course Outline:

The weekly coverage might change depending on the progress of the class. Selected applications from various scientific disciplines will be chosen based on interests of students. Extra topics may include debugging, sorting algorithms, recursion, image processing, topics from statistics, or topics from basic graph theory.

Week	Content
Week 1	<ul style="list-style-type: none">• Introduction to Python, object-oriented programming, Scientific Computing• Installation• Python interactive session• Jupyter notebooks
Week 2	<ul style="list-style-type: none">• Lists• Strings• Numeric data types
Week 3	<ul style="list-style-type: none">• Modules• NumPy• Numerical differentiation (finite differences)• Numerical integration (Riemann sums)
Week 4	<ul style="list-style-type: none">• Scientific plotting with <code>matplotlib</code>
Week 5	<ul style="list-style-type: none">• Control structures• <code>for</code> loops• Conditional Statements• Random Numbers and Probability (Monte Carlo simulations)
Week 6	<ul style="list-style-type: none">• More control structures• <code>while</code> loops• Custom functions, modules• Solving Nonlinear Equations (Newton's method)
Week 7	<ul style="list-style-type: none">• Ordinary Differential Equations (forward Euler)• Optimization (steepest descent, simulated annealing)
Week 8	<ul style="list-style-type: none">• Defining classes• Encapsulation• Cellular Automata
Week 9	<ul style="list-style-type: none">• Good software practices• Tic-Tac-Toe• More Optimization (genetic algorithms)
Week 10	<ul style="list-style-type: none">• Reading and writing files• Statistics
Week 11	<ul style="list-style-type: none">• More on classes, inheritance
Week 12	<ul style="list-style-type: none">• Selected applications
Week 13	<ul style="list-style-type: none">• Final project presentations