



Department of Physics and Astronomy  
PHY 277 Syllabus  
Fall 2023

**Important Note:** Every effort will be made to avoid changing the course schedule, but the possibility exists that unforeseen events will make syllabus changes necessary. It is your responsibility to check Brightspace for corrections or updates to the syllabus. Any changes will be clearly noted in course announcements on Brightspace and through Stony Brook email.

**Part 1: Course Information**

**Course title:** Computation for Physics and Astronomy

**Course catalog # and section:** PHY 277 sections 1 & 2

**Credit hours:** 3

**Semester:** Fall 2023

**General education designation(s) (SBC) :** TECH

**Prerequisites:** PHY 125, PHY 126, PHY 127 and PHY 133, PHY 134; or PHY 131/133, PHY 132/134; or PHY 141/133, PHY 142/134; AMS 151 or MAT 126 or MAT 131 or MAT 141

**Advisory Prerequisite:** AMS 161 or MAT 127 or MAT 132 or MAT 142 or MAT 171

**Instructor name:** F. Douglas Swesty

**Contact:** [douglas.swesty@stonybrook.edu](mailto:douglas.swesty@stonybrook.edu), Phone: 631-632-8055, Office: 463 Earth & Space Sciences Building (**Note: There will be no in-person office hours**)

**Office hours:** MWF 1:00-2:00PM, via Zoom or by appointment

**TA Information:** To be announced

**Course Description:** An introduction to computing on UN\*X/Linux computers. Fundamentals of using UN\*X/Linux to write computer programs for numerical algorithms to solve computational physics and astronomy problems. Assignments are carried out in a high-level compiled programming language such as Modern Fortran or Modern C++ and require extensive use of Linux computers outside the classroom.

**Required Course Textbook and Materials:** No required textbook

**Recommended Readings/Bibliography:** Course notes (posted as PDF files in advance of lectures on Brightspace), course videos posted on Youtube (links will be provided in the course Brightspace site; closed captioning is available).

**Course Examination Dates and Times:**

*This course has two evening midterm (as well as a final exam) exams scheduled by the Registrar. It is your responsibility to consult the Registrar's Midterm and Final Exam Schedules to avoid scheduling another course or activity that conflicts with these exams. You must schedule your other courses so that they do not conflict with the scheduled exams. In the event of any scheduling conflict you will be required to attend the PHY 277 exams. No alternative exam times will be offered.*

**Course Delivery Mode and Structure:**

This is an in-person course with three lectures per week delivered MWF in Math S-235 (located in the basement of the Math Tower). Office hours with the instructors and teaching assistants will be held via Zoom.

Students must be mindful of all course expectations and due dates, especially because this online course requires significant time management. All assignments and course interactions will utilize internet technologies. See "Technical Requirements" section for more information. In Brightspace, you will access course materials, assignments, and additional resources. Each week of the semester has programming assignments; with deadlines usually on Fridays. Some variations in assignment due dates will occur but will be announced via Brightspace and email to your SBU email address.

Office hours will take place completely online via Zoom meetings. Using Zoom allows you to share your computer programs with the instructors and teaching assistants so that we can help you to solve problems. Be prepared to share the screen of your device via Zoom.

**How We Will Communicate:**

Course-related questions should be asked during lectures, via email messages to the instructors or teaching assistants, or during office hours via Zoom. For personal/private issues, email me directly to set up a Zoom meeting. **Please allow between 24 hours for an email reply except for weekends and holidays when the reply will usually be sent on the following business day.** Your Stony Brook University email must be used for all University-related communications. You must have an active Stony Brook University email account and access to the Internet. All Instructor and Teaching Assistant correspondence will be sent to your SBU email account. The Instructor and Teaching Assistants will not respond to emails from private email accounts.

**Plan on checking your SBU email account daily for course-related messages.** To log in to Stony Brook Google Mail, go to <http://www.stonybrook.edu/mycloud> and sign in with your NetID and password.

**Technical Requirements:**

This course uses Brightspace and Zoom for the facilitation of communications between faculty and students, submission of assignments, and posting of grades and feedback. The Brightspace course site can be accessed at <https://mycourses.stonybrook.edu> Zoom may be accessed at [stonybrook.zoom.us](https://stonybrook.zoom.us) Both Brightspace and Zoom require authentication using your NetID. If you are unsure of your NetID, visit <https://it.stonybrook.edu/help/kb/finding-your-netid-and-password> for more information. Links to the lecture and office hour Zoom meetings will be posted on Brightspace.

This course will require you to **have access to a computer having an PDF file viewer and an ssh client** so that you may access the Matlab Linux systems at [portal.mathlab.stonybrook.edu](http://portal.mathlab.stonybrook.edu) or [portal2.mathlab.stonybrook.edu](http://portal2.mathlab.stonybrook.edu) (how to connect remotely will be discussed during the course lectures). All SBU students have physical access to SINC site computers which have ssh clients and PDF file viewers installed. It is recommended that the computer you use to attend office hours (via Zoom) have a webcam. At a minimum the computer you use to attend office hours will need a microphone and speaker to enable communication with the instructor or teaching assistants. This course will also provide links to online video recordings posted on Youtube designed to further explain the subject material covered during the lectures. It is recommended that you use a computer that has a speaker so that you may hear the narration during the video although Youtube does provide closed captioning for the videos.

If you choose to use your own computer **you are responsible for having a reliable computer, with an ssh client, PDF file viewer, and web browser, and Internet connection** throughout the term. **The University assumes no liability if you choose make use of your own computer or install any software on your computer.**

Note: It is not necessary for you to have the Linux operating system installed on your computer.

**Caution!** You will be at a disadvantage if you attempt to complete all coursework using a smart phone or tablet. It may not be possible to access the Matlab Linux systems or submit the files required for your homework assignments from a smartphone or tablet.

Students should be able to use email and navigate the SBU Brightspace website to complete this course successfully.

**Technical Assistance:**

If you need technical assistance at any time during the course or to report a problem with Brightspace you can:

- Phone: 631-632-9800 (client support, Wi-Fi, software and hardware)
- Submit a help request ticket: <https://it.stonybrook.edu/services/itsm>
- If you are on campus, visit the Walk-Up Tech Support Station in the Student Activities Center (SAC) building.

If you need technical assistance with your personal computer you can:

- If you are on campus, visit the Walk-Up Tech Support Station in the Student Activities Center (SAC) building.

## Part 2: Course Learning Objectives and Assessments

### Course Learning Objectives / Student Learning Outcomes

Upon completion of the course, students will be able to:

1. Use the Linux command line interface to carry out typical scientific computing tasks on Linux computers.
2. Write, debug, and test simple computer programs in the Modern Fortran language.
3. Write, debug, and test simple computer programs in Modern C++ language.
4. Create scientific documents using the LaTeX typesetting system.

**Assessments and Grading:** Course grades will be based on: 1. Assignments including programming assignments (typically assigned weekly) 2. Two in-person midterm exams (scheduled **in the evening** by the Registrar). 3. An in-person final exam (scheduled by the Registrar) 4. Grade penalties for non-attendance.

**Assignment 1:** (on software plagiarism) must be completed before any programming assignment. **Failure to complete assignment 1 to the satisfaction of the Instructor before submitting any work for other programming assignments will result in a SCORE OF ZERO any subsequent programming assignment until such time as Assignment 1 is completed. Failure to complete assignment 1 by the end of the semester will mean that your entire programming assignment score for the semester will be zero. There are no exceptions to this policy.**

**Programming Assignments:** Programming assignments will be graded on the basis of correctness, efficiency of the program, programming style, and other metrics that the Instructor and Teaching assistants may choose to use. There may be specific instructions for each assignment that you will have to follow in addition to general instructions that will be announced in class. It is the expectation that you will complete these assignments on the Matlab Linux systems by logging in remotely to edit, debug, and test your codes. Code that does not compile and run on the Matlab Linux systems will always receive a grade of zero. There are no exceptions to this policy. If an assignment will not count towards the grade the assignment will state this clearly.

**Viewing assessment scores on Brightspace:** Points and feedback for graded assessments will be posted to Brightspace. Grades for assessments will typically be posted within one week, however in rare instances there may be exceptions to this timing.

**Course score:** The course score will be weighted as follows: (20%) for the programming assignments, (20%) for each midterm examination, and (40%) for the final exam. The course score will be normalized to a percentage (100 will be a perfect score for the course).

**Attendance:** Attendance of all classes for PHY 277 is required. Unexcused absences from class may result in your grade being lowered as described below. **Absences will only be excused when proof of legitimate reason has been verified through the Office of the Dean of Students** or the Athletic Department (in the case of student athletes) or for religious holidays (when the instructor has been contacted in advance).

### Grading Scale:

Grades will be assigned based on your scores on assessments. Scores will be computed as

$$\text{score} = 0.2 \times \text{normalized midterm 1 score} + 0.2 \times \text{normalized midterm 2 score} + \\ 0.2 \times \text{normalized total homework score} + 0.4 \times \text{normalized final exam score}$$

The scores for each assessment are normalized to a scale of 0-100.

The following thresholds for pre-penalty grades will be calculated:

- **A** score  $\geq 85$
- **A-**  $85 > \text{score} \geq 75$
- **B+**  $75 > \text{score} \geq 70$
- **B**  $70 > \text{score} \geq 65$
- **B-**  $65 > \text{score} \geq 60$
- **C+**  $60 > \text{score} \geq 55$
- **C-**  $55 > \text{score} \geq 45$
- **F** score  $< 45$

Note that no "D" grades will be awarded for this course. The instructor reserves the right to lower the thresholds (but in no case will the thresholds be raised)

**The pre-penalty grades calculated based on scores will be further adjusted downward according to the following penalties:**

- Failure to complete assignment 1 will result in an automatic course grade of F
- The pre-penalty grade will be adjusted downwards by one letter grade for each four recorded unexcused absences, e.g. having 5 unexcused absences will result in a grade of B+ being lowered to a grade of C+. Grades of C+ and C will be lowered to C- and a grade of C- will be lowered to F for more than four unexcused absences. Attendance

will be taken by random sampling of the class at the beginning of the lecture period. If you are late for lecture by even thirty seconds you will be marked absent.

### Additional Information

- [Undergraduate Grading System](#)
- [Graduate Grading System](#)

**Excused Absences:** Absences from class will only be excused for student athletes (when the instructor receives prior notification from the Athletic Office) or when absent for an extended period of time due to military service, jury duty, mandatory court appearances, physical/mental illness, or death of a family member. **All proof of such extended absences must be submitted to the Office of the Dean of Students (Student Activities Center, Suite 222, phone: 631-632-7320).** Only after such proof has been verified by the Office of the Dean of Students will absences be excused. Absences because of religious holidays will also be excused provided the instructor is notified in advance of the absence.

### How to Succeed in this Course:

- After each lecture you should read the course lecture notes and attempt to replicate the example programs included in the notes. You should complete all the tasks listed at the end of each set of lecture notes. You must keep up with the lectures by studying the lecture notes after each lecture. If you do not keep up with the lecture material YOU ARE LIKELY TO FAIL THIS COURSE. You cannot succeed in this course by "cramming" the material all at once no matter how good your memorization technique is.
- You should plan on spending two hours working through the lecture notes for each hour spent in lecture. In addition you will have to devote substantial amounts of time (usually at minimum of several hours per week) to complete the programming assignments.
- You should write as many programs as you can. You should reproduce the examples in the notes and get those example programs running by yourself. Practice, practice, practice!
- Ask or help from the Instructor and TAs. We will have office hours throughout the week where you can ask for help. We are happy to provide that help. Please take advantage of this opportunity to enhance your likelihood of success.
- For more time on task information, see NY State Education Department: <http://www.nysed.gov/college-university-evaluation/distance-education-program-policies>

<b>Part 3: Course Schedule</b>
--------------------------------

**Lecture Topics:**

Date	Topic (subject to change)
Lect 1	Course and University policies. Bash shell; Basic Linux commands; Connecting remotely via SSH
Lect 2	Editing files with Emacs; A first Fortran program; Using the compiler.
Lect 3	Binary data representation.; Data types in Fortran; Floating point representation
Lect 4	Fortran character set; Fortran statements; Structure of Fortran programs; Fortran variables
Lect 5	Fortran declaration statements; Fortran assignment statements; Fortran parameters
Lect 6	List directed I/O; Debugging strategies; Computer arithmetic; Intrinsic Functions
Lect 7	Shell aliases; Fortran relational and logical operators; Character variables; STDIN & STDOUT and redirection
Lect 8	Directory listings & file permissions; IF constructs.
Lect 9	Wildcards & globbing; Top-down design; Algorithms; Fortran nested IF constructs.
Lect 10	Obsolete Fortran constructs; X11 tunneling; Using Gnuplot
Lect. 11	Floating point equality tests; Safe divides; Gnuplot
Lect 12	Loop constructs; Using loops for summation & products
Lect. 13	The LaTeX typesetting system
Lect. 14	Numerical integration with loops
Lect. 15	Root finding examples using loops; Newton-Raphson iteration
Lect. 16	Input and output to files in Fortran
Lect. 17	Fortran arrays
Lect 18	Dynamic arrays in Fortran.
Lect. 19	Multidimensional arrays

Lect. 20	Fortran subroutines; the Fortran argument passing mechanism
Lect. 21	Fortran modules
Lect. 22	Function subprograms in Fortran; Extended precision in Fortran
Lect. 23	Makefiles
Lect. 24	Introduction to C++
Lect. 25	Introduction to C++ part 2
Lect. 26	Integrating dynamical equations of motion; Euler's method
Lect. 27	Integrating dynamical equations of motion part 2; Runge-Kutta method;
Lect. 28	C++ functions
Lect. 29	C++ arguments passing; C++ arrays
Lect. 30	C++ multidimensional arrays
Lect. 31	C++ pointers; Dynamic arrays in C++
Lect. 32	C++ file input and output; Least squares fitting example in C++
Lect. 33	C++ structs; Fortran derived types
Lect. 34	C++ classes; C++ namespaces; ; building Fortran classes with modules and derived types
Lect. 35	C++ method functions; Fortran type-bound procedures
Lect. 36	Encapsulation in C++ and Fortran; C++ class constructors
Lect. 37	Inheritance in C++ and Fortran
Lect. 38	Static polymorphism in C++ and Fortran
Lect. 39	Static polymorphism in C++ and Fortran
Lect. 40	Dynamic polymorphism; the $\rightarrow$ operator in C++; the Select type construct in Fortran
Lect. 41	Virtual functions in C++



Lect. 42	Generic programming with C++ templates

#### Part 4: Late Work Policies

**Late Work Policy (including exams):** Late work is not accepted except for excused absences (including religious holidays when the instructor is contacted in advance). Explanations of lost passwords, internet outage, power outage, computer malfunction, etc. **WILL NEVER BE ACCEPTED** as an excuse for failure to submit your work for an assignment by the specified deadline. **For this reason you should complete all assignments at least 24 hours prior to the deadline.** Therefore proper planning is necessary on your part to make sure that you can complete your work in advance of the deadline for submission.

#### Part 5: University and Course Policies

##### University Policies:

##### Student Accessibility Support Center Statement:

If you have a physical, psychological, medical, or learning disability that may impact your course work, please contact the Student Accessibility Support Center, Stony Brook Union Suite 107, (631) 632-6748, or at [sasc@stonybrook.edu](mailto:sasc@stonybrook.edu). They will determine with you what accommodations are necessary and appropriate. All information and documentation is confidential.

Students who require assistance during emergency evacuation are encouraged to discuss their needs with their professors and the Student Accessibility Support Center. For procedures and information go to the following website:

<https://ehs.stonybrook.edu//programs/fire-safety/emergency-evacuation/evacuation-guide-disabilities> and search Fire Safety and Evacuation and Disabilities.

##### Academic Integrity Statement:

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. Faculty **are required** to report any suspected instances of academic dishonesty to the Academic Judiciary. Faculty in the Health Sciences Center (School of Health Technology & Management, Nursing, Social Welfare, Dental Medicine) and School of Medicine are required to follow their school-specific procedures. For more comprehensive information on academic integrity, including categories of academic dishonesty please refer to the academic judiciary website at [http://www.stonybrook.edu/commcms/academic\\_integrity/index.html](http://www.stonybrook.edu/commcms/academic_integrity/index.html)

**Critical Incident Management:**

Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of Student Conduct and Community Standards any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn. Faculty in the HSC Schools and the School of Medicine are required to follow their school-specific procedures. Further information about most academic matters can be found in the Undergraduate Bulletin, the Undergraduate Class Schedule, and the Faculty-Employee Handbook.

**Course Policies:****Course Assignments & Academic Integrity Violation Policy:**

Your grade in this course is, in part, based on software you will author in response to assignments that are given for this course. The key word here is “author”. Like authorship of any other document, authorship of software provides the possibility of plagiarism. Any attempt to submit work that draws from software authored by someone other than yourself is plagiarism and is an instance of an academic integrity violation. Any attempt to aid other students in authoring their software is also an instance of an academic integrity violation. You may not copy code from any source including, but not limited to, books, web sites, or other persons. By the use of the term “copy” we include electronic copies obtained by copying a computer file as well as reproducing code from other sources by typing it in, scanning it, optical character recognition, or any other means of reproducing that code. Your code must be authored solely by you. Altering variable names, spacing, reformatting, rearranging statements, changing file names, etc. of code from some other source does not result in original work and submitting such work as your own is an academic integrity violation. Debugging your code must be your own work and should be done solely by yourself with the following exception: you may request help in debugging from the Instructor and the Teaching Assistants for this course (hereafter TAs) but you may not obtain help from any other person. Any instance of obtaining help from anyone other than the Instructor and the course TAs to author or debug software that you submit for assignments will be considered an academic integrity violation. Students in this course may not discuss the software that they or another person are submitting in response to the course assignments with anyone other than the Instructor or the course TAs. Discussion of the software submitted in response to the assignments with anyone other than the Instructor or course TAs will be considered academic integrity violation.

The Stony Brook University Provost’s Academic Integrity Policy of August 2019 states “ *Course Instructors who suspect violations of academic integrity must report their suspicions to the Academic Judiciary Office; they may not establish a penalty independently.*” The course Instructor has no discretion in this matter. Accordingly any instance in which we suspect (we do not require definitive proof) that an academic integrity violation has occurred will, without

exception, be reported to the Academic Judiciary Office. Once a report has been filed the Academic Judiciary Office ( [academic\\_judiciary@stonybrook.edu](mailto:academic_judiciary@stonybrook.edu)) has established formal procedures to handle the matter once suspected violations have been reported.

**Understand When You May Drop This Course:**

It is the student's responsibility to understand when they need to consider withdrawing from a course. Refer to the Stony Brook Academic Schedule for dates and deadlines for registration: [http://www.stonybrook.edu/commcms/registrar/calendars/academic\\_calendars](http://www.stonybrook.edu/commcms/registrar/calendars/academic_calendars).

- [Undergraduate Course Load and Course Withdrawal Policy](#)
- [Graduate Course Changes Policy](#)

**Incomplete Policy:**

Under emergency/special circumstances, students may petition for an incomplete grade. Circumstances must be documented and significant enough to merit an incomplete. If you need to request an incomplete for this course, contact me for approval as far in advance as possible.

**Course Materials and Copyright Statement:**

Course material accessed from Brightspace, SB Connect, SB Capture or a Stony Brook Course website is for the exclusive use of students who are currently enrolled in the course. Content from these systems cannot be reused or distributed without written permission of the Instructor and/or the copyright holder. Duplication of materials protected by copyright, without permission of the copyright holder is a violation of the Federal copyright law, as well as a violation of Stony Brook's Academic Integrity policy.

**Online Communication Guidelines and Learning Resources:**

Maintain professional conduct both in the classroom and online. The classroom is a professional environment where academic debate and learning take place. I will make every effort to make this environment safe for you to share your opinions, ideas, and beliefs. In return, you are expected to respect the opinions, ideas, and beliefs of other students—both in the face-to-face classroom and online communication. Students have the right and privilege to learn in the class, free from harassment and disruption. The course follows the standards set in the Student Code of Conduct, and students are subject to disciplinary action for violation of that code.

**My Role as the Instructor:**

As the Instructor, I will serve as a "guide" to the course material. I will present a lecture explaining the material through slides and examples shown in real time. I will answer any questions you may have related to the course material. In addition will suggest reading for you and videos for you to watch which will enhance your learning experience. I, and the course TAs, will be available during office hours and by appointment to answer any questions that you have and assist you in the completion of your programming assignments. Office hours and contact information of myself and the TAs will be posted on the course Brightspace site.

## Part 6: Student Resources

Academic and Major Advising (*undergraduate only*): Have questions about choosing the right course? Contact an advisor today. Phone and emails vary-please see website for additional contact information; website: <https://www.stonybrook.edu/for-students/academic-advising/>  
**Physics and Astronomy majors should see the Department of Physics & Astronomy Director of Undergraduate Studies, Prof. Dominik Schneble, in the Department's main office for advice.**

Academic Success and Tutoring Center (*undergraduate only*):  
<https://www.stonybrook.edu/tutoring/>

Bursar: For help with billing and payment. Phone: 631-632-9316; email: [bursar@stonybrook.edu](mailto:bursar@stonybrook.edu); website: <http://www.stonybrook.edu/bursar/>

Career Center: The Career Center's mission is to support the academic mission of Stony Brook University by educating students about the career decision-making process, helping them plan and attain their career goals, and assisting with their smooth transition to the workplace or further education. Phone: 631-632-6810; email: [sbucareercenter@stonybrook.edu](mailto:sbucareercenter@stonybrook.edu); website: <http://www.stonybrook.edu/career-center/>

Counseling and Psychological Services: CAPS staff are available by phone, day or night.  
<http://studentaffairs.stonybrook.edu/caps/>

Ombuds Office: The Stony Brook University Ombuds Office provides an alternative channel for confidential, impartial, independent and informal dispute resolution services for the entire University community. We provide a safe place to voice your concerns and explore options for productive conflict management and resolution. The Ombuds Office is a source of confidential advice and information about University policies and procedures and helps individuals and groups address university-related conflicts and concerns. <http://www.stonybrook.edu/ombuds/>

Registrar: Having a registration issue? Let them know. Phone: 631-632-6175; email: [registrar\\_office@stonybrook.edu](mailto:registrar_office@stonybrook.edu); <http://www.stonybrook.edu/registrar/>

SBU Libraries: access to and help in using databases, ebooks, and other sources for your research.

- Research Guides and Tutorials: <http://guides.library.stonybrook.edu/>

- Getting Help: <https://library.stonybrook.edu/research/ask-a-librarian/>

Student Accessibility Support Center: Students in need of special accommodations should contact SASC. Phone: 631-632-6748; email: [sasc@stonybrook.edu](mailto:sasc@stonybrook.edu);  
<https://www.stonybrook.edu/sasc/>

Support for Online Learning: <https://www.stonybrook.edu/online/>

Writing Center: Students are able to schedule face-to-face and online appointments.  
<https://www.stonybrook.edu/writingcenter/>