PHYS 513 – Computational Physics

COURSE SYLLABUS: Spring 2026

INSTRUCTOR INFORMATION

Instructor: Dr. Heungman Park, Associate Professor of Physics and Astronomy
Office Location: Science Building room 240
Office Hours: [Monday, Wednesday: 10:00 AM - 12:30 PM] or by appointment
Office Phone: 903-886-8654 (Department main office)
Office Fax: 903-886-5480 (Department of Physics and Astronomy)
University Email Address: heungman.park@etamu.edu
Preferred Form of Communication: email
Communication Response Time: within 48 hours

COURSE INFORMATION

This course requires face-to-face physical classroom attendance.

Materials – Textbooks, Readings, Supplementary Readings

Textbook(s) Required: Computational Physics by Mark Newman. ISBN-10: 1480145513, ISBN-13: 978-1480145511
Software Required: Anaconda Python 3.x package and vpython library.
Optional Texts and/or Materials: none

Course Description

This self-contained course provides a rigorous introduction to the Python programming language and its scientific computing. Students will develop computational proficiency before applying these tools to advanced topics in numerical analysis and computational physics. Covered subjects include finite-difference techniques, algorithms for solving linear and nonlinear systems, discrete Fourier transforms, and numerical simulation of physical systems governed by ordinary and partial differential equations. The course also examines stochastic modeling, random processes, and Monte Carlo methods, with an emphasis on algorithmic accuracy, stability, and computational efficiency. Prerequisites: Programming experience is required such as Python, C, C++, Java with concepts of functions.

Student Learning Outcomes

1. Develop a foundational understanding of scientific computing, numerical simulation, and computational modeling, with emphasis on their theoretical and practical implementations.

2. Acquire proficiency in using Matplotlib and related visualization tools to generate informative, high-quality graphical representations of numerical data and simulation results.

3. Build critical intuition for assessing the validity, accuracy, and stability of computational outcomes, recognizing that error-free program execution does not necessarily imply physically or mathematically correct results.

COURSE REQUIREMENTS

Minimal Technical Skills Needed

Basic computer skills such as internet surfing and installing programs. Programming experience will be required.

Hardware for the class

A decent computer (desktop or laptop) is required to run the Python programming language package (Anaconda package). Minimum computer specification: a quad core CPU above 3.0 GHz and 8 GB memory.

Instructional Methods

Computational physics has become an essential methodology for investigating complex natural phenomena and its applications. In this course, students will first develop proficiency in the Python programming language and in data visualization using Matplotlib. The remainder of the course introduces a range of core computational techniques and numerical methods central to modern computational physics. This is a hands-on, practice-driven course in which students will actively engage in writing, executing, and debugging code to obtain physically meaningful and scientifically credible results. Emphasis is placed on understanding both the implementation of numerical algorithms and the inherent limitations, approximations, and sources of error in computational simulations. The skills acquired will serve as a foundation for advanced study and research in physics and related disciplines.

Student Responsibilities or Tips for Success in the Course

Students must check a course website. All assignments are posted on the course website.

GRADING

Final grades in this course will be based on the following scale:

A = 90%-100%

B = 80%-89%

C = 70%-79%

D = 60%-69%

F = 59% or Below

Grading Procedure

- Attendance: 5%, Quiz: 5%, Homework: 10%
- Term project: 20%

- Midterm exams: 30%
- Comprehensive final exam: 30%

* The scales can be adjusted by the instructor. The final grading policy will be announced before the final exam.

** If a student's attendance is below 50%, the students will receive an "F" grade.

TECHNOLOGY REQUIREMENTS

LMS

All course sections offered by East Texas A&M University have a corresponding course shell in the myLeo Online Learning Management System (LMS). Below are technical requirements

LMS Requirements:
https://community.brightspace.com/s/article/Brightspace-Platform-Requirements

LMS Browser Support:
https://documentation.brightspace.com/EN/brightspace/requirements/all/browser_support.htm

YouSeeU Virtual Classroom Requirements:
https://support.youseeu.com/hc/en-us/articles/115007031107-Basic-System-Requirements

ACCESS AND NAVIGATION

You will need your campus-wide ID (CWID) and password to log into the course. If you do not know your CWID or have forgotten your password, contact the Center for IT Excellence (CITE) at 903.468.6000 or helpdesk@tamuc.edu.

Note: Personal computer and internet connection problems do not excuse the requirement to complete all course work in a timely and satisfactory manner. Each student needs to have a backup method to deal with these inevitable problems. These methods might include the availability of a backup PC at home or work, the temporary use of a computer at a friend's home, the local library, office service companies, Starbucks, a TAMUC campus open computer lab, etc.

COMMUNICATION AND SUPPORT

If you have any questions or are having difficulties with the course material, please contact your Instructor.

Technical Support

If you are having technical difficulty with any part of Brightspace, please contact Brightspace Technical Support at 1-877-325-7778. Other support options can be found here:

https://community.brightspace.com/support/s/contactsupport

Interaction with Instructor Statement

The instruction will respond within 24 hours by email. Each graded assignment and test will be returned within a week.

COURSE AND UNIVERSITY PROCEDURES/POLICIES

Course Specific Procedures/Policies

General Classroom
No food is allowed during class except for beverages with lids.
Students are expected to be on time and present for all class meetings. If an emergency results in an absence, the student should contact the instructor as soon as possible informing the instructor of the emergency and inquiring about ways to make up the missed class. The instructor will make judgment on how to handle the situation. Possible reasons for excused absence are listed in the "Student's Guidebook" under class attendance policy. Attendance and tardy records will be maintained and both may result in deductions from your overall grade. Five unexcused absences will automatically result in a failing grade.

Homework: Each student must work on the assigned homework problems on his/her own time. Collaboration is encouraged, but students must understand what they did on the work and be able to explain it to the instructor. If only answers are shown, no credits may be given.

Penalties of Late Work: 20 % deduction within 48 hours, 30% deduction within 96 hours, and no credits after then.

Exams: There will be three midterm exams and a comprehensive final exam. Make-up exams will only be allowed for excused absences such as sickness with a doctor's note and jury duty. Only one make-up exam is allowed. The final exam must be taken.
In-class Quiz: A quiz will be given once or twice a week. Quiz contents will be announced during the lecture.

Syllabus Change Policy

The syllabus is a guide. Circumstances and events, such as student progress, may make it necessary for the instructor to modify the syllabus during the semester. Any changes made to the syllabus will be announced in advance.

University Specific Procedures

Student Conduct

All students enrolled at the University shall follow the tenets of common decency and acceptable behavior conducive to a positive learning environment. The Code of Student Conduct is described in detail in the Student Guidebook.
http://www.tamuc.edu/Admissions/oneStopShop/undergraduateAdmissions/studentGuidebook.aspx

Students should also consult the Rules of Netiquette for more information regarding how to interact with students in an online forum: https://www.britannica.com/topic/netiquette

TAMUC Attendance

For more information about the attendance policy please visit the [Attendance](http://www.tamuc.edu/admissions/registrar/generalInformation/attendance.aspx) webpage and [Procedure 13.99.99.R0.01](http://www.tamuc.edu/admissions/registrar/generalInformation/attendance.aspx).
http://www.tamuc.edu/admissions/registrar/generalInformation/attendance.aspx

http://www.tamuc.edu/aboutUs/policiesProceduresStandardsStatements/rulesProcedures/13students/academic/13.99.99.R0.01.pdf

Academic Integrity

Students at East Texas A&M University are expected to maintain high standards of integrity and honesty in all of their scholastic work. For more details and the definition of academic dishonesty see the following procedures:

Undergraduate Academic Dishonesty 13.99.99.R0.03

http://www.tamuc.edu/aboutUs/policiesProceduresStandardsStatements/rulesProcedures/13students/undergraduates/13.99.99.R0.03UndergraduateAcademicDishonesty.pdf

Graduate Student Academic Dishonesty 13.99.99.R0.10

http://www.tamuc.edu/aboutUs/policiesProceduresStandardsStatements/rulesProcedures/13students/graduate/13.99.99.R0.10GraduateStudentAcademicDishonesty.pdf

Students with Disabilities-- ADA Statement

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you have a disability requiring an accommodation, please contact:

Office of Student Disability Resources and Services
East Texas A&M University
Gee Library- Room 162
Phone (903) 886-5150 or (903) 886-5835
Fax (903) 468-8148
Email: studentdisabilityservices@tamuc.edu

Website: Office of Student Disability Resources and Services

http://www.tamuc.edu/campusLife/campusServices/studentDisabilityResourcesAndServices/

Nondiscrimination Notice

East Texas A&M University will comply in the classroom, and in online courses, with all federal and state laws prohibiting discrimination and related retaliation on the basis of race, color, religion, sex, national origin, disability, age, genetic information or veteran status. Further, an environment free from discrimination on the basis of sexual orientation, gender identity, or gender expression will be maintained.

Campus Concealed Carry Statement

Texas Senate Bill - 11 (Government Code 411.2031, et al.) authorizes the carrying of a concealed handgun in East Texas A&M University buildings only by persons who have been issued and are in possession of a Texas License to Carry a Handgun. Qualified law enforcement officers or those who are otherwise authorized to carry a concealed handgun in the State of Texas are also permitted to do so. Pursuant to Penal Code (PC) 46.035 and East Texas A&M University Rule 34.06.02.R1, license holders may not carry a concealed handgun in restricted locations.

For a list of locations, please refer to the [Carrying Concealed Handguns On Campus](#) document and/or consult your event organizer.

Web url:
http://www.tamuc.edu/aboutUs/policiesProceduresStandardsStatements/rulesProcedures/34Safety
OfEmployeesAndStudents/34.06.02.R1.pdf

Pursuant to PC 46.035, the open carrying of handguns is prohibited on all East Texas A&M University campuses. Report violations to the University Police Department at 903-886-5868 or 9-1-1.

East Texas A&M University Supports Students' Mental Health

The Counseling Center at East Texas A&M University, located in the Halladay Building, Room 203, offers counseling services, educational programming, and connection to community resources for students. Students have 24/7 access to the Counseling Center's crisis assessment services by calling 903-886-5145. For more information regarding Counseling Center events and confidential services, please visit **www.tamuc.edu/counsel**

Artificial Intelligence Software Usage Policy

East Texas A&M University acknowledges that there are legitimate uses of Artificial Intelligence, ChatBots, or other software that has the capacity to generate text, or suggest replacements for text beyond individual words, as determined by the instructor of the course.

Any use of such software must be documented. Any undocumented use of such software constitutes an instance of academic dishonesty (plagiarism).

Individual instructors may disallow entirely the use of such software for individual assignments or for the entire course. Students should be aware of such requirements and follow their instructors' guidelines. If no instructions are provided the student should assume that the use of such software is disallowed.

In any case, students are fully responsible for the content of any assignment they submit, regardless of whether they used an AI, in any way. This specifically includes cases in which the AI plagiarized another text or misrepresented sources.

13.99.99.R0.03 Undergraduate Academic Dishonesty
13.99.99.R0.10 Graduate Student Academic Dishonesty

COURSE OUTLINE / CALENDAR

The course schedule is subject to change.

				Lecture Schedule
Week 1	1/12/2026	-	1/16/2026	Basic Python programing 1
Week 2	1/19/2026	-	1/23/2026	Basic Python programing 2
Week 3	1/26/2026	-	1/30/2026	Basic Python programing 3
Week 4	2/2/2026	-	2/6/2026	Making plots with Matplotlib
Week 5	2/9/2026	-	2/13/2026	3D vector plots with VPython 1
Week 6	2/16/2026	-	2/20/2026	3D vector plots with VPython 2
Week 7	2/23/2026	-	2/27/2026	Accuracy and speed
Week 8	3/2/2026	-	3/6/2026	Integrals and derivatives 1
Week 9	3/9/2026	-	3/13/2026	**<< Spring Break >>**
Week 10	3/16/2026	-	3/20/2026	Integrals and derivatives 2
Week 11	3/23/2026	-	3/27/2026	Solution of linear and nonlinear equations 1
Week 12	3/30/2026	-	4/3/2026	Solution of linear and nonlinear equations 2
Week 13	4/6/2026	-	4/10/2026	Fourier transforms
Week 14	4/13/2026	-	4/17/2026	Random processes and Monte Carlo Methods
Week 15	4/20/2026	-	4/24/2026	Selected topics 1
Week 16	4/27/2026	-	5/1/2026	Selected topics 2
Week 17	5/4/2026	-	5/8/2026	**Final exam**