

PHY4905/5905: Computational Physics Spring 2022 Syllabus

Instructor

Prof. Laura Blecha

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Office location & phone: NPB 2075, (352) 392-4948

(Note: email and Canvas are the best ways to contact me.)

Class meeting times & location

Tuesdays: 10:40 am – 12:35 pm (Periods 4 & 5)

Thursdays: 10:40 am – 11:30 am (Period 4)

(All times listed in this syllabus are in the Eastern time zone.)

Classroom: NPB 1002

Office hours

- To be determined
- You are always welcome to contact me via email or Canvas to set up a meeting outside of office hours.

Course description and objectives

This course provides an introduction to computational methods and modeling in physics. Basic numerical methods used in computational physics are introduced, including derivatives, integration, solutions to differential equations, linear algebra, fitting methods, and Monte Carlo methods, with applications to a variety of physics topics. The main goal of this course is to empower students in using numerical techniques to solve scientific problems.

Textbook and Technology

Recommended textbook: "Computational Physics" by Newman (ISBN: 978-1480145511). Includes a helpful website with exercises and code examples:

<http://www-personal.umich.edu/~mejn/cp>

Recommended technology: We will be doing many in-class activities that will primarily involve writing code. You are strongly encouraged to bring a laptop with you to each class session. Homework assignments will also require access to a computer with internet access.

Other resources:

- Official Python documentation: <https://docs.python.org>

- “Think Python: How to Think Like a Computer Scientist” Available for free online: <http://greenteapress.com/wp/think-python-2e/>
- William H. Press, Saul A. Teukolsky, William T. Vetterling, Brian P. Flannery “Numerical Recipes 3rd Edition: The Art of Scientific Computing”, 3rd edition, Cambridge University Press 2007. The 3rd edition of this book is available for free online: <http://numerical.recipes>

Prerequisites

- **Undergraduate students:** at least 12 credits of physics and/or instructor permission
- **Physics graduate students:** none
- **Graduate students in other departments:** instructor permission

Assignments

Homework assignments will be due approximately every week, and they will be submitted by uploading them to your online code repository. Your lowest homework score will be dropped from your grade. Therefore, late assignments will require a documented excuse. Exceptions for illness, hardship, or extenuating circumstances will be reviewed on a case-by-case basis.

The other component of your grade will be two computing projects. One will be due approximately midway through the term, and the other will be due at the end of the term. These will be more open-ended than the homework, emphasizing the goal of thinking like a scientist and using numerical methods for scientific inquiry. For both projects, late assignments will not be allowed without a documented medical or other extenuating circumstance.

Grading

Grading will be based on a scale from 0 to 100 percentage points. The final grade is calculated as follows: Homeworks: 70%, Projects: 30%. Homework assignments will be graded according to a pre-defined rubric. The conversion to letter grades will be done using the following table after rounding the total percentage points to zero decimal places. Grade cutoffs may be lowered, but they will not be raised. Your scores will be entered into Canvas in a timely manner. Below I discuss each component of your grade in more detail. The strictest grade policy that I will adopt will follow this scheme:

| | | | | | | | | | | | |
|------|------|------|------|------|------|------|------|------|------|------|------|
| A | A- | B+ | B | B- | C+ | C | C- | D+ | D | D- | E |
| ≥ 93 | ≥ 90 | ≥ 87 | ≥ 83 | ≥ 80 | ≥ 77 | ≥ 73 | ≥ 70 | ≥ 67 | ≥ 63 | ≥ 60 | < 60 |

Course schedule (tentative – subject to change)

The schedule below lists the topics planned for each lecture, as well as the corresponding chapters and sections in the textbook. This schedule is likely to evolve. Changes will be announced on Canvas as well as during class time. Please check Canvas and your UF e-mail regularly for changes and class announcements. It is your responsibility to be aware of changes posted on Canvas or sent by e-mail.

| Lecture # | Date | Topics |
|-----------|------|--|
| 1 | 1/6 | Introduction to Python and Computing Environment Setup |
| 2 | 1/11 | More Python; Version Control |
| 3 | 1/13 | Version Control |
| 4 | 1/18 | Essentials of Scientific Computing |
| 5 | 1/20 | Essentials of Scientific Computing |
| 6 | 1/25 | Numerical Differentiation Methods |
| 7 | 1/27 | Numerical Integration Methods |
| 8 | 2/1 | Numerical Integration Methods |
| 9 | 2/3 | Numerical Integration Methods |
| 10 | 2/8 | Random Processes & Monte Carlo Methods |
| 11 | 2/10 | Random Processes & Monte Carlo Methods |
| 12 | 2/15 | Random Processes & Monte Carlo Methods |
| 13 | 2/17 | Random Processes & Monte Carlo Methods |
| 14 | 2/22 | Linear Algebra |
| 15 | 2/24 | Linear Algebra |
| 16 | 3/1 | Root Finding Methods |
| 17 | 3/3 | Root Finding Methods |
| N/A | 3/8 | No Class – Spring Break |
| N/A | 3/10 | No Class – Spring Break |
| 18 | 3/15 | Solving ODEs and PDEs |
| 19 | 3/17 | Solving ODEs and PDEs |
| 20 | 3/22 | Fourier transforms |
| 21 | 3/24 | Fourier transforms |
| 22 | 3/29 | Collaborative Code Development Environments |
| 23 | 3/31 | Collaborative Code Development Environments |
| 24 | 4/5 | Data Fitting and Smoothing |
| 25 | 4/7 | Data Fitting and Smoothing |
| 26 | 4/12 | Overflow; Final Projects |
| 27 | 4/14 | Final Projects |
| 28 | 4/19 | Final Project Presentations |

Inclusive learning environment

Physics is practiced and advanced by a scientific community of individuals with diverse backgrounds and identities and is open and welcoming to everyone. I recognize the

value of diversity, equity, and inclusion in all aspects of this course. This includes but is not limited to a diversity of age, background, ethnicity, gender identity and expression, national origin, religious affiliation, sexual orientation, and other visible and non-visible categories that you bring with you to our shared study of physics. In this small class, we will be working closely together throughout the semester. I expect that all students will contribute to a respectful, welcoming, and inclusive environment. This includes attentive listening, showing patience with each other, and respect for all questions asked by members of the class.

Physics, like all human endeavors, is something that is learned. My aim is to foster an atmosphere of learning that is based on inclusion, transparency, and respect for all participants. I acknowledge the different needs and perspectives we each bring to our common learning space and strive to provide everyone with equal access. **All students meeting the course prerequisites belong here and are well positioned for success.**

Accessibility

I am committed to supporting the learning process for all students. You are encouraged to contact me as soon as possible if you are having difficulties in the course. Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the Disability Resource Center (352-392-8565, <https://disability.ufl.edu>). It is important for students to share their accommodation letter with their instructor and discuss their access needs as early as possible in the semester.

Health & safety

In response to COVID-19, the following practices are in place to maintain your learning environment, to enhance the safety of our in-classroom interactions, and to further the health and safety of ourselves, our neighbors, and our loved ones.

- **If you are not vaccinated, get vaccinated. You are also encouraged to get a vaccine booster if you are eligible.** Vaccines are readily available at no cost and have been demonstrated to be safe and effective against the COVID-19 virus. Visit this link for details on where to get your shot, including options that do not require an appointment: <https://coronavirus.ufhealth.org/vaccinations/vaccine-availability/>. Students who receive the first dose of the vaccine somewhere off-campus and/or outside of Gainesville can still receive their second dose on campus.
- **You are expected to wear approved face coverings at all times during class and within buildings even if you are vaccinated.** Please continue to follow healthy habits, including best practices like frequent hand washing. Following these practices is our responsibility as Gators.

- Sanitizing supplies are available in the classroom if you wish to wipe down your desks prior to sitting down and at the end of the class.
- Hand sanitizing stations will be located in every classroom.
- **If you are sick, stay home and self-quarantine.** Please visit the [UF Health COVID-19 information website](#) about next steps. Please call your primary care provider if you are ill and need immediate care or the UF Student Health Care Center at 352-392-1161 (or email covid@shcc.ufl.edu) to be evaluated for testing and to receive further instructions about returning to campus. UF Health offers guidance when you are sick, have been exposed to someone who has tested positive or have tested positive yourself. Visit the [UF Health COVID-19 information website](#) for more information.
 - Course materials will be provided to you with an excused absence, and you will be given a reasonable amount of time to make up work.
 - **If you are withheld from campus by the Department of Health, you are not permitted to use any on-campus facilities.** Students attempting to attend campus activities when withheld from campus will be referred to the Dean of Students Office.
- **Continue to regularly visit coronavirus.UFHealth.org and coronavirus.ufl.edu for up-to-date information about COVID-19 and vaccination.**

Class attendance

Requirements for class attendance, assignments, and other work in this course are consistent with university policies that can be found at:

<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>

UF grading policies

Information on current UF grading policies for assigning grade points can be found here:

<https://catalog.ufl.edu/UGRD/academic-regulations/grades-grading-policies/>

Online course evaluation

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals.

Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summary results of these assessments are available to students at <https://gatorevals.aa.ufl.edu/public-results/>.

The Honor Pledge

UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: ‘On my honor, I have neither given nor received unauthorized aid in doing this assignment.’ The Honor Code (<http://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.”

In-class recording policy

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A class lecture is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To publish means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third-party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

Campus resources

Health, wellness, & basic needs

- U Matter, We Care: If you or a friend is in distress, please contact umatter@ufl.edu or (352) 392-1575 so that a team member can reach out to the student.
- Counseling and Wellness Center: <https://counseling.ufl.edu/>, 392-1575 (or 9-1-1 for emergencies).
- Title IX Office: 427 Yon Hall, <https://titleix.ufl.edu/get-help/> (Includes a list of on- & off-campus resources)
- Student Health Care Center, 392-1161, <https://shcc.ufl.edu>
- UF Aid-a-Gator Program. Provide grants to students experiencing unanticipated expenses due to an emergency situation. <https://www.sfa.ufl.edu/aidagator/>

Academic resources

- E-learning technical support, 352-392-4357 (select option 2) or e-mail to Learningsupport@ufl.edu. <https://lss.at.ufl.edu/help.shtml> .
- Career Connections Center, Reitz Union, 392-1601. Career assistance and counseling. <https://career.ufl.edu/>
- Library Support, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.
- Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. <http://teachingcenter.ufl.edu/>
- Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers. <http://writing.ufl.edu/writing-studio/>
- Student Complaints: <https://registrar.ufl.edu/writtencomplaints>; <http://distance.ufl.edu/student-complaint-process/>