PHYS3340-001-1217

PHYS 3340

Computational Physics

Instructor Information

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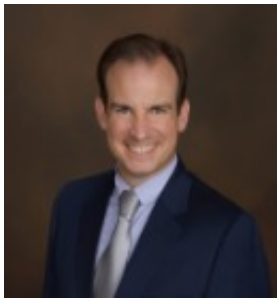
Sign up using your Canvas Calendar



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Meeting Times & Location

Tuesday/Thursday | 12:30pm | Owen Fine Arts Center 1040

Course Information

Course Description

- Primarily, this will be an introduction to the modeling of physical systems with emphasis on algorithm selection and implementation for simulating classical and quantum physics.
- We will be using primarily C and Python languages, with some optional Mathematica code.

Course Objectives

This course is intended to introduce students to the foundational skills and approaches...
Students will learn to:

- Program in C and Python
- Develop strategy and tools for efficient debugging
- Learn to work within modern development interfaces (e.g., ManeFrame, Eclipse, Jupyter Lab ...)
- Learn to make use of standard external libraries (e.g., Gnu Scientific Library)
- Learn to use modern code versioning systems and repositories (CVS, GitHub, ...)
  Note, CVS is not to be confused with CVS or CSV

Course Materials

Selected recommended texts.

- Numerical Mathematics and Computing by E Ward Cheney E. W. Cheney **LINK** **(https://www.amazon.com/dp/1133491812/ref=cm_sw_em_r_mt_dp_EZ4R83YFF0KS0TY6BJBC?_encoding=UTF8&psc=1)**
  This is the official course text we'll use for reference: don't spend more than $30 for this; older editions are OK.
- Introduction to Computation and Programming Using Python: With Application to Computational Modeling and Understanding Data by John V. Guttag **LINK** **(https://www.amazon.com/dp/0262542366/ref=cm_sw_em_r_mt_dp_4FYAMRBV2Q2X0BVHSNAK?_encoding=UTF8&psc=1)**
  This is the recommend text for Python.

OPTIONAL texts (have a look at my copy before you purchase).

- Mathematica for Physics: by Robert L. Zimmerman, Fredrick I. Olness **LINK** **(https://www.amazon.com/dp/0805387005/ref=cm_sw_em_r_mt_dp_VRHE7DA1YQE3S86F2C1W)**
  This has many example problems worked out in Mathematica. (You can generally get used for $30 or less.)
- Learning Scientific Programming with Python by Christian Hill **LINK** **(https://www.amazon.com/gp/product/110742822X/ref=ppx_yo_dt_b_asin_title_o02_s00?ie=UTF8&psc=1#)**
  A useful reference for Python
- A Student's Guide to Python for Physical Modeling by Jesse M. Kinder, Philip Nelson **LINK** **(https://www.amazon.com/dp/0691180571/ref=cm_sw_em_r_mt_dp_5NCD5DH9N36WKMMF0MW9?**

_encoding=UTF8&psc=1)
A useful reference for Python

Assignments

- The primary assignments will be coding homework. Some will be submitted via Canvas, and programming code will be submitted via GitHub.
- Homework will be due WEDNESDAY evening at 11:59pm as we will review the solutions in class Thursday.
- LATE HOMEWORK: Homework grade is reduced 20% the first day and 10% per day thereafter; this is important as I often review homework in class.

Help Sessions:

- We will have regular help sessions on Wednesday (***TBD**, late afternoon or early evening*). As the homework is due Wednesday evening, this is an ideal time to get answers to your questions.

- #### Grading Overview

    1. **[60% of final grade]** Homework assignments
    2. **[20% of final grade]** Quizzes: both in-class and take-home
    3. **[20% of final grade]** Final project & quiz

Attendance

Attendance is required. If you will miss class, please inform the instructor in advance.

University Honor Code

The student honor code can be found on page 32 of the student handbook [1] (syllabus2.html#fn1x0) . All students will be expected to adhere to it. Any student found cheating or plagiarizing another's work will be given a zero for that work and a complaint will be filed through the Vice President for Student Affairs Office. If you are uncertain of the definition of plagiarism as it regards independent works of mathematical and physical computation, documentation, and demonstration, it is your responsibility to speak with the instructor and understand these rules.

Disability Accommodations

Students needing academic accommodations for a disability must first register with Disability Accommodations & Success Strategies (DASS). Students can call 214-768-1470 or visit **http://www.smu.edu/Provost/SASP/DASS (http://www.smu.edu/Provost/SASP/DASS)** to begin the process. Once approved and registered, students will submit a DASS Accommodation Letter to faculty through the electronic portal DASS Link and then communicate directly with each instructor to make appropriate arrangements. Please note that accommodations are not retroactive and require advance notice to implement.

University Policy on Religious Observance

Religiously observant students wishing to be absent on holidays that require missing class should notify their professors in writing at the beginning of the semester, and should discuss with them, in advance, acceptable ways of making up any work missed because of the absence. (**https://www.smu.edu/StudentAffairs/Chaplain/ReligiousHolidays (https://www.smu.edu/StudentAffairs/Chaplain/ReligiousHolidays)**).

Excused Absences for University Extracurricular Activities

Students participating in an officially sanctioned, scheduled University extracurricular activity should be given the opportunity to make up class assignments or other graded assignments missed as a result of their participation. It is the responsibility of the student to make arrangements with the instructor prior to any missed scheduled examination or other missed assignment for making up the work. (See **2020-2021 SMU Undergraduate Catalog (https://catalog.smu.edu/content.php?catoid=51&navoid=4645&hl=%22excused+absences%22&returnto=search)** under "Enrollment and Academic Records/Excused Absences.")

Student Academic Success Programs

Students needing assistance with writing assignments for SMU courses may schedule an appointment with the Writing Center through Canvas. Students wishing support with subject-specific tutoring or success strategies should contact SASP, Loyd All Sports Center, Suite 202; 214-768-3648; **https://www.smu.edu/sasp (https://www.smu.edu/sasp)** .

Accommodations for pregnant and parenting students

Under Title IX students who are pregnant or parenting may request academic adjustments by contacting Elsie Johnson (elsiej@smu.edu) in the Office of the Dean of Students, or by calling 214-768-4564. Students seeking assistance must schedule an appointment with their professors as early as possible, present a letter from the Office of the Dean of Students, and make appropriate arrangements. Please note that academic adjustments are not retroactive and, when feasible, require advance notice to implement.

Covid-19 Attendance Statement

Students who are experiencing COVID-19 symptoms or who have been notified through contact tracing of potential exposure and need to self-quarantine or isolate must follow the protocols laid out in **SMU's Contact Tracing Protocol (https://www.smu.edu/Coronavirus/Contact-Tracing)**. To ensure academic continuity, students in these situations will not be penalized and will be provided appropriate modifications to assignments, deadlines, and testing. Please also note that SMUFlex classes might, in rare circumstances, go remote for two-week periods to accommodate COVID-related issues. To ensure these necessary accommodations, affected students must:

- Provide as much advance notification as possible to the instructor about a change in circumstances. Students must notify their instructor about a potential absence as well as plans for a return to class. For cases in which students test positive for COVID-19, they should fill out a **CCC form at this link (https://cm.maxient.com/reportingform.php?SouthernMethodistUniv&layout_id=1)**.
- Communicate promptly with the instructor to establish, as necessary, alternative assignments and/or changes to deadlines and exams. Students are then responsible for meeting the expectations laid out in these alternative arrangements.
- Continue participation in class via Zoom, as health circumstances permit. Attend class regularly, when not in a situation outlined above, in accordance with safety measures laid out by SMU CAN in the **Pledge to Protect (https://smu.az1.qualtrics.com/jfe/form/SV_2ib3rgSmWNktGvj)** (including wearing masks, maintaining social distancing, and cleaning personal space after class). In-person participation in SMUFlex classes is required on students' assigned red/blue rotation days except in cases when students are experiencing illness, are in self-quarantine or in isolation.
- Students facing multiple or extended COVID-19-related absences or illness can work with the Office of the Dean of Students to consider options such as fully remote learning or medical withdrawal.

This policy, aligned with the **SMU Honor Code (https://www.smu.edu/StudentAffairs/OfficeoftheDeanofStudents/StudentConduct/HonorCouncil)** and the **SMU Pledge to Protect (https://smu.az1.qualtrics.com/jfe/form/SV_2ib3rgSmWNktGvj)**, relies on mutual trust and respect between students and faculty to ensure safety, academic integrity, and instructional continuity.

Covid-19 Class Mask Policy

Masks are required in this course. This masking policy is subject to change during the semester, and any changes will be posted clearly in Canvas announcements.

Statement regarding the "campus carry" law

In accordance with Texas Senate Bill 11, also known as the "campus carry" law, following consultation with entire University community SMU determined to remain a weapons-free campus. Specifically, SMU prohibits possession of weapons (either openly or in a concealed manner) on campus. For more information, please see: **http://www.smu.edu/BusinessFinance/Police/Weapons_Policy (http://www.smu.edu/BusinessFinance/Police/Weapons_Policy)**.

Quantitative Reasoning

Student Learning Outcome: Students will demonstrate an ability to interpret mathematical models in the form of formulas, graphs, and/or tables and draw inferences from them.

Supporting Skills:

- Students will interpret and translate between multiple different representations of information, such as visual, numerical, symbolic, and/or verbal representations.
- Students will use equations and/or principles to solve for an unknown quantity.
- Students will evaluate whether an argument or conclusion is valid and/or reasonable.
- Students will articulate an argument for an issue that uses quantitative data in a meaningful way.

Exploring Science

Student Learning Outcome: Students will demonstrate an ability to engage in scientific inquiry with respect to the natural world.

Supporting Skills:

- Students will identify and organize evidence necessary to analyze or solve a problem in the natural world.
- Students will describe and explain concepts that are needed to analyze or solve a problem of the natural world.
- Students will analyze the outcomes and consequences, given information about a natural phenomenon.

Quantitative Applications

Student Learning Outcome: Students will demonstrate an ability to interpret mathematical models in the form of formulas, graphs, and/or tables and draw inferences from them in a specified domain.

Supporting Skills:

- Students will select appropriate quantitative methods for domain-specific problems based on evaluation of assumptions for those methods.
- Students will apply the appropriate quantitative methods to solve domain-specific problems.
- Students will present a conclusion based on a quantitative argument in domain-specific language.
- Students will evaluate whether an argument or conclusion is valid and/or reasonable within a specified domain.

Course Schedule: *(details may be adjusted as needed)*

2021 FALL PHYS 3340

#	DAY	LECTURE:	NOTES:	TOPIC	H
1	TUE	08/24/21	First Class	Basic Skills: M2, Virtual Desktop	
2	THUR	08/26/21		C programming intro, GitHub	
3	TUE	08/31/21		Debugging: DDD, Eclipse	
4	THUR	09/02/21		Visualizing Numerical Data, GnuPlot	
5	TUE	09/07/21	John Fattaruso	Computer Precision & Numerical representation	
6	THUR	09/09/21	John Fattaruso	Computer Precision & Numerical representation	
7	TUE	09/14/21	Eric Godat	Introduction to Python	
8	THUR	09/16/21	Eric Godat	Python	
9	TUE	09/21/21		Roots of Functions	
10	THUR	09/23/21		Gnu Scientific Library (GSL)	
11	TUE	09/28/21		Systems of Linear Equations	
12	THUR	09/30/21			
13	TUE	10/05/21		Nonlinear Equations	
14	THUR	10/07/21			
	TUE	10/12/21	**Fall Break**		
15	THUR	10/14/21		Monte Carlo Simulation	
16	TUE	10/19/21			
17	THUR	10/21/21		Interpolation	
18	TUE	10/26/21			
19	THUR	10/28/21		Numerical Integration	
20	TUE	11/02/21			
21	THUR	11/04/21	Drop Date	Numerical Differentiation	
22	TUE	11/09/21			
23	THUR	11/11/21		ODE's Initial Value Problems	
24	TUE	11/16/21			
25	THUR	11/18/21		ODE's Boundary Value Problems	
26	TUE	11/23/21			
27	THUR	11/25/21	**Thanksgiving**	No Class	
28	TUE	11/30/21			
29	THUR	12/02/21	**Last Class**		
	MON	**Dec 13**	**FINAL EXAM**	**Monday Dec. 13, 2021, 11:30am – 2:30pm**	

Adjustments may be made depending on student interests/needs and unplanned events