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## SFSU PHYS 701: Classical Mechanics

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Prof. Joseph Barranco

barranco@sfsu.edu

Thornton Hall 334, (415) 338-2450

<https://faculty.sfsu.edu/~barranco>

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### Lectures & Office Hours

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Lectures: TR 14:00-15:15, Thornton Hall 425

Office Hours: T 15:30-16:45 (after class) & R 12:30-13:45 (before class) in Thornton Hall 334

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### Quick note on e-mail contact

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So that I can identify and respond to e-mails from you expeditiously, please put [PHYS701] at the beginning of the subject line. I will respond to emails within 48 hours. Please use email for administrative matters or short clarifications of lecture or homework problems. More extensive help with homework and/or detailed explications of lectures are best done in person in office hours.

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### Course Website

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<https://canvas.sfsu.edu/canvas> – Please check frequently for new announcements, updates to the syllabus & schedule, and links to additional learning resources.

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### Course Topics

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PHYS 701 is an advanced course in classical mechanics. Topics include: Lagrangian dynamics, symmetries & Noether's Theorem, central forces and potentials (gravitation, Coulomb scattering), accelerating reference frames, rigid-body dynamics, Hamiltonian dynamics. Applications will especially be drawn from celestial dynamics and astrodynamics.

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### Course Format

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This is a 3-unit lecture course in graduate level physics; it is expected that students will attend and participate in lecture and associated activities for 2.5 hours per week, and read, study, reflect on the course material, and complete homework assignments for a minimum of 5.0 hrs per week. [Note: the minimum is not a guarantee of any particular grade, especially a grade of A which will require as much time as necessary to acquire competency in the course material.]

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### Course Objectives

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- (1) To analyze real-world systems in mechanics, to make valid approximations and develop simplified models of such systems, and then to employ Newton's Laws of Motion, Lagrange's equations or Hamilton's equations to determine a system's temporal evolution.
- (2) To understand and apply the fundamental conservation principles of classical physics (energy, linear momentum, angular momentum) and relate them to underlying symmetries of nature.
- (3) To develop and apply mathematical tools (vector calculus, linear algebra, differential equations, calculus of variations, numerical/computational methods) to solve problems in classical mechanics.

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### Recommended Preparation

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Intermediate courses in classical mechanics or dynamics, vector calculus, linear algebra, ordinary differential equations, some computer programming.

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### Learning Materials

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"Newtonian Dynamics" by Richard Fitzpatrick, online textbook:

<https://farside.ph.utexas.edu/teaching/336k/Newton/index.html>

"Introduction to Celestial Mechanics" by Richard Fitzpatrick, online textbook:

<https://farside.ph.utexas.edu/teaching/celestial/Celestial/Celestial.html>

Mathematica, Matlab, or Python. SF State students have free licenses for Mathematica & Matlab:

<https://athelp.sfsu.edu/hc/en-us/sections/360009101134-Software-and-licensing>

Jupyter Notebooks with Python Anaconda can be downloaded from:

<https://www.anaconda.com/download>

## Assignment of Grades

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Grades will be determined according to the following rubric:

Bi-weekly Homework:	85%	
Oral Final Exam:	15%	scheduled for December 11-13

Letter grades will assigned according to the following scheme:

	A: 90.00% – 100.0%	A-: 85.00% – 89.99%
B+:	80.00% – 84.99%	B: 75.00% – 79.99%
B-:	70.00% – 74.99%	C+: 65.00% – 69.99%
C-:	60.00% – 64.99%	C: 55.00% – 59.99%
D+:	50.00% – 54.99%	D: 45.00% – 49.99%
D-:	40.00% – 44.99%	F: 00.0% – 39.99%

I may, at my discretion, curve upwards if I feel my assignments were too difficult and/or the class performed above my expectations despite actual course scores. I will never curve downwards.

## Homework

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You cannot learn physics solely from lectures. You must work through many problems, seeing how the theoretical concepts discussed in lecture apply in various contexts. Homework is an integral part of the learning process; how serious you take the homework will ultimately determine how much you will understand physics and how well you will do in the course overall. There will be approximately one homework assignment every other week. Most problems will require analytic solutions, however there will usually be one problem per assignment that will involve graphing and numerical solution with computer software such as MATLAB, Mathematica, or Python.

Homework can be hand-written, but it should be legible. Show all significant steps in any calculations. State any outside resources used. Graphs should be computer generated with clearly labelled axes and a concise, content-rich caption. Please upload homework as a single, combined PDF in Canvas.

**Late policy:** Students have a bank of 21 late days (weekends and holidays included); partial days count as full days. After the bank of late days is exhausted, late work will still be accepted with a flat 25% penalty, but absolutely no later than the hard final deadline December 13, 2023. For example, you could turn in one assignment 14 days late, and another assignment 7 days late, both with no penalty; but, the next assignment you turn in late will be penalized. You do NOT need to request extensions; I will keep track via our learning management system Canvas.

## Policy on Collaboration & Academic Integrity

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You are strongly encouraged to discuss course material with your fellow classmates. When working on homework, first try to solve the problems on your own. Struggle. Struggle some more. If you get stuck, feel free to discuss overall methods and approaches with your classmates, but not the details! Your written solutions should be solely your own, and should be written-up in isolation from your fellow classmates. Copying is strictly prohibited. Using the internet to download solutions manuals is also considered cheating. Cheating via any method on exams will result in a grade of zero on that exam and being reported to the department chair and/or college dean for possible discipline.

## Add, Drop, Withdrawal & Repeat Policy, Grade Option Deadline

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**Monday, September 11: Add/drop deadline.** You can drop yourself from the class online without any penalty and without any record, for any reason. After September 11, students must petition for an official withdrawal.

**Friday, December 1: Change grade option deadline (letter grade to CR/NC and vice versa).** *Note that a letter grade is required if your degree program is M.S. Astronomy & Astrophysics. For graduate courses, students must earn at least B-minus for CR.*

**Monday, November 13: Withdrawal for “serious & compelling reasons” deadline.** If the petition is approved, the designation “W” will appear on the transcript. Students are only allowed to repeat a class once at SFSU. Note that designations of W, WU, NC count toward this limit.

**Friday, December 8: Withdrawal “by exception for documented serious & compelling reasons” deadline.** Documents must be provided to support the petition to withdraw. If the petition is approved, the designation “W” will appear on the transcript. Students are only allowed to repeat a class once at SFSU. Note that designations of W, WU, NC count toward this limit.

## Intellectual Property

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I, Joseph Barranco, own the copyright for all of the homework assignments, homework solutions, written quizzes & exams, written solutions for quizzes & exams that I have produced for this course. Do not use, reproduce, or post online (e.g. social media, electronic bulletin boards, free or commercial “tutoring” websites) without explicit written permission.

## Expected Code of Conduct

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Classroom discussion and participation are strongly encouraged. However, please refrain from unrelated chatter. Also, please remember to place cell phones and other electronic communication devices on silent or vibration mode so as not to distract your fellow classmates. If you must arrive late or leave early, please sit toward the back of the room near the doors so as to minimize disruption.

Students may not capture audio, photos, or video from class sessions on their own devices without the explicit permission of the instructor and everyone present, unless part of a DPRC-authorized accommodation.

Students may not post any course materials to any third-party sites or post any recordings, screenshots, audio or chat transcripts in any setting outside the class; violations of this are subject to student disciplinary action.

In the mission statement of the department, we state: “The pursuit of science is a human endeavor, and our department welcomes the full spectrum of humanity to contribute their perspectives, passions, and skills to scientific exploration.” The Department of Physics & Astronomy will not tolerate any behaviors or actions from faculty, staff, and students that has negative impact on the educational & professional opportunities of any member of the department. Discrimination on the basis of race, ethnicity, nationality, religion, sex, sexual orientation, gender, gender identity, gender expression, marital status, medical condition, genetic information, veteran or military status, is strictly prohibited.

Please pay close attention to the official SF State “Nondiscrimination Policy and Complain Procedures”:

<https://bulletin.sfsu.edu/policies-procedures/nondiscrimination-policy/>

Violations of expected code of conduct will be reported to the Office of Student Conduct.

## Disability Access

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Students with disabilities who need reasonable accommodations are encouraged to contact me early in the semester. The Disability Programs and Resource Center is available to facilitate the reasonable accommodations process. The DPRC, located in Student Services Building 110, can be reached by phone at 415-338-2472 (voice/TTY) or by e-mail at [dprc@sfsu.edu](mailto:dprc@sfsu.edu).

## Religious Holidays

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The faculty of San Francisco State University shall accommodate students wishing to observe religious and cultural holidays when such observances require students to be absent from class activities. It is the responsibility of the student to inform the instructor, in writing, about such holidays during the first two weeks of the class each semester. If such holidays occur during the first two weeks of the semester, the student must notify the instructor, in writing, at least three days before the date that they will be absent. It is the responsibility of the instructor to make every reasonable effort to honor the student request without penalty, and of the student to make up the work missed.

## Student Disclosures of Sexual Violence

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SF State fosters a campus free of sexual violence including sexual harassment, domestic violence, dating violence, stalking, and/or any form of sex or gender discrimination. If you disclose a personal experience as an SF State student, the course instructor is required to notify the Dean of Students. To disclose any such violence confidentially, contact:

The SAFE Place - (415) 338-2208; [http://www.sfsu.edu/~safe\\_plc/](http://www.sfsu.edu/~safe_plc/)

Counseling and Psychological Services Center - (415) 338-2208; <http://psyservs.sfsu.edu/>

For more information on your rights and available resources - <http://titleix.sfsu.edu>