Course Syllabus

PHYS 4410: Classical Physics I

Lecture

TH 2:00-3:55 PM, JFB 103

Course Description

This course will first review vector calculus and Newtonian Mechanics, including conversation laws. Following this, we introduce the formalism of Lagrangian and Hamiltonian dynamics: a more general approach to thinking about mechanics (and beyond). This will enable us to formally and rigorously consider several important applications of the general principles. The course will use vector calculus and other relevant mathematical concepts (such as tensors), however many necessary mathematical results (e.g. basics of calculus of variations) will be covered in class itself.

Prerequisites: PHYS 2220 or PHYS 3220, and MATH 2210 and MATH 2250. Corequisites: MATH 3150.

Instructor

Douglas Bergman

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Office hours: W 2-3

TA

Yue Yao

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Textbook

Classical Dynamics of Particles and Systems (5th edition), Thornton & Marion, Brooks Cole, 2003. ISBN-10: 0534408966, ISBN-13: 978-0534408961.

Homework

There will be roughly one homework per week (assigned Thursday, due in class the following Thursday). The graded homework will be returned on Thursdays. Students are expected to attempt problems on their own. Discussions with other students are permitted, but students should turn in their own work. Half of Thursday's class will be devoted to problem solving, together with a discussion of the graded homework. The first homework will be due on August 31.

Exams

There will be two 1-hour midterm exams: 2017/10/05 and 2017/11/09, to be administered during the regular class time and in the class room. There will be a *take-home* final examination, to be turned in by the end of the day, 2017/12/13.

ADA Statement

The University of Utah seeks to provide equal access to its programs, services and activities for people with disabilities. If you will need accommodations in the class, reasonable prior notice needs to be given to the Center for Disability Services, 162 Union Building, 581-5020 (V/TDD). CDS will work with you and the instructor to make arrangements for accommodations.

Rights & Responsibilities

All students are expected to maintain professional behavior in the classroom setting, according to the Student Code, spelled out in the Student Handbook. Students have specific rights in the classroom as detailed in Article III of the Code. The Code also specifies proscribed conduct (Article XI) that involves cheating on tests, plagiarism, and/or collusion, as well as fraud, theft, etc. Students should read the Code carefully and know they are responsible for the content. According to Faculty Rules and Regulations, it is the faculty responsibility to enforce responsible classroom behaviors, and I will do so, beginning with verbal warnings and progressing to dismissal from and class and a failing grade. Students have the right to appeal such action to the Student Behavior Committee.

Weekly Schedule

Week 1 (8/22-24): Coordinate systems & transformations

Week 2 (8/29-31): Vector calculus: grad, div, curl, divergence & Stokes theorems

Week 3 (9/5-7): Newton's Laws. Conservation of energy & momentum

Week 4 (9/12-14): Stability, non-conservative forces. Oscillations

Week 5 (9/19-21): Oscillations

Week 6 (9/26-28): Calculus of Variations. Euler's Equation.

Week 7 (10/3-5): Hamilton's Principle, Action, Lagrangian

Week 8 (10/17-19): Noether's Theorem, Hamiltonian

Week 9 (10/24-26): Legendre Transformations, Canonical Equations

Week 10 (10/31-11/2): Liouville Theorem, Equipartition Theorem

Week 11 (11/7-9): Central Force Motion, Gravity, Orbits

Week 12 (11/14-16): Kepler's Laws, Laplace-Runge-Lenz vector

Week 13 (11/21): Scattering, stability of orbits

Week 14 (11/28-30): Many particle systems, non-inertial reference frames

Week 15 (12/5-7): Rigid-body dynamics, Inertia tensor

Course Summary:

Date	Details	
Thu Aug 31, 2017	**HW 1** (https://utah.instructure.com/courses/459178/assignments/4075188)	due by 2pm
Thu Sep 7, 2017	**HW 2** (https://utah.instructure.com/courses/459178/assignments/4075191)	due by 2pm
Thu Sep 14, 2017	**HW 3** (https://utah.instructure.com/courses/459178/assignments/4075196)	due by 2pm
Thu Sep 21, 2017	**HW 4** (https://utah.instructure.com/courses/459178/assignments/4075210)	due by 2pm
Thu Sep 28, 2017	**HW 5**	

	📝	[(https://utah.instructure.com/courses/459178/assignments/4075211)](https://utah.instructure.com/courses/459178/assignments/4075211)	due by 2pm
Thu Oct 5, 2017	📝	**Midterm 1** [(https://utah.instructure.com/courses/459178/assignments/4075200)](https://utah.instructure.com/courses/459178/assignments/4075200)	due by 2:55pm
Thu Oct 19, 2017	📝	**HW 6** [(https://utah.instructure.com/courses/459178/assignments/4075217)](https://utah.instructure.com/courses/459178/assignments/4075217)	due by 2pm
Thu Oct 26, 2017	📝	**HW 7** [(https://utah.instructure.com/courses/459178/assignments/4075218)](https://utah.instructure.com/courses/459178/assignments/4075218)	due by 2pm
Thu Nov 2, 2017	📝	**HW 8** [(https://utah.instructure.com/courses/459178/assignments/4075219)](https://utah.instructure.com/courses/459178/assignments/4075219)	due by 2pm
Thu Nov 9, 2017	📝	**Midterm 2** [(https://utah.instructure.com/courses/459178/assignments/4075204)](https://utah.instructure.com/courses/459178/assignments/4075204)	due by 2:55pm
Thu Nov 16, 2017	📝	**HW 9** [(https://utah.instructure.com/courses/459178/assignments/4075220)](https://utah.instructure.com/courses/459178/assignments/4075220)	due by 2pm
Thu Nov 30, 2017	📝	**HW 10** [(https://utah.instructure.com/courses/459178/assignments/4075221)](https://utah.instructure.com/courses/459178/assignments/4075221)	due by 2pm
Thu Dec 7, 2017	📝	**HW 11** [(https://utah.instructure.com/courses/459178/assignments/4075223)](https://utah.instructure.com/courses/459178/assignments/4075223)	due by 2pm
	📝	**Midterm 3** [(https://utah.instructure.com/courses/459178/assignments/4491949)](https://utah.instructure.com/courses/459178/assignments/4491949)	due by 3pm
Wed Dec 13, 2017	📝	**Final Exam** [(https://utah.instructure.com/courses/459178/assignments/4075206)](https://utah.instructure.com/courses/459178/assignments/4075206)	due by 5pm