PHYS 705 Classical Mechanics, Syllabus (FALL 2022, 8/22 – 12/14)
Monday, 4:30 – 7:10 pm, Exploratory Hall 1004
Prof Dr. Erdal Yiğit

1. Topics:

Elementary mechanics	Central force and Kepler problems
Constraints and Generalized coordinates	Hamiltonian mechanics
D'Alembert principle and Lagrange equations	Canonical transformations
Calculus of variations	Hamilton-Jacobi equation
Conservation laws	Rigid body mechanics
Dynamical systems	

2. Required & recommended textbook: We will use the Classical Mechanics textbook by Goldstein, Poole, and Safko (G) as the main text (required). Overall, mainly materials from chapters 1 – 6, and 8 – 9 will be presented. Also, the book by Thornton & Marion (TM), Classical Dynamics of particles and systems is recommended. Occasionally, various sections may be covered as part of the lecture.

3. Tentative Weekly schedule:

08/22 Lecture 1	Review of Newtonian mechanics Constraints	G 1.1 – 1.3
08/29 Lecture 2	D'Alembert's principle Lagrange's equations (LEs)	G 1.4 – 1.6
09/05	*Labor day (No classes)*	
09/12 Lecture 3	Hamilton's principle (HP) Calculus of variations Derivation of LEs from HP	G 2.1 – 2.3
09/19 Lecture 4	Calculus of variations, Conservation theorems Symmetries	G 2.6 – 2.7
09/26 Lecture 5	Central force problem I	G 3.1 – 3.3, 3.5
10/03 Lecture 6	Kepler's problems	G 3.6 – 3.8
10/10	*Fall Break -> Classes meet on 10/11 (Tue)*	
10/11 Lecture 7	Hamilton's equations I	G. 8.1
10/17 Lecture 8	Hamilton's equations II	G. 8.2 - 8.3
10/24 Lecture 9	Hamilton's equations III	G 8.5 – 8.6
10/31 Lecture 10	Canonical transformations	G 9.1 – 9.5
	Depending on the progress of the class and available time, the following topics may change or previous topics may be continued	
11/7 Lecture 11	Hamilton- Jacobi Equation & Hamilton Principal Function	G 10.1 – 10.2
11/14 Lecture 12	Oscillations	G 6.1 – 6.4
11/21 Lecture 13	Rigid body motion, Euler Angles	G 4.1 – 4.4 G 4.6 – 4.10
11/28 Lecture 14	The rigid body equation of motion; Classical chaos and mechanics of fluids	G 5, G11
12/3	*Last day of classes*	
12/05 – 12/6 (Mon-Tue)	*Reading days*	
12/7-12/14	*Examination period*	

4. **Course website:** https://sites.google.com/view/erdalyigit/teaching/classical-mechanics

5. **Instructor & Office Hours:** Erdal Yiğit (eyigit@gmu.edu), Physics and Astronomy, Space Weather Lab, Planetary Hall 261. Thursday, 14:00-15:00.

6. **Course goals:** Understand advanced topics of classical mechanics.

7. **Course policy and grading:** 30% final exam, 70% homeworks. Homeworks are due beginning of class every Monday. You have one week to work on assignments. 10% will be subtracted for each late day of submission.
   Grade scale:
   100-95% (A+), 95-90% (A), 90-85% (A-), 85-80% (B+), 80-75% (B), 75-70% (B-), 70-60% (C), < 60% (F)

8. **Howeworks:** In every assignment, 5% of your grade will be based on the following criteria:
   a. Write clearly and provide understandable and well organized solutions
   b. Number each page; clearly indicate which problem you are working on; start each problem solution on a new page.
   c. Incorporate additional guidelines and suggestions discussed in the lecture.
   d. Add some (brief) explanations in your derivations and problem solutions so that it is clear what your solution path is.
   e. Staple your sheets in the right order.

Successful solution of all problems will give you 95%. To get 100% you need solve all the problems and fulfill all the criteria above (+5%) in your submission. Depending on the performance and issues that can arise, this list may be updated during the semester.

Note that lack of clarity and organization in a given problem solution or derivation will lead to point subtractions even if the final solution is correct.

All HW assignments can be found on the course website. HW solutions are to be submitted by the beginning of class.

You can type your solutions using latex, word, or any other equation editor, or simply submit handwritten solutions, following (a)-(e) above.

10% will be subtracted for each late day of submission.

9. **Academic integrity:** GMU is an Honor Code university; please see the University Catalog for a full description of the code and the honor committee process. The principle of academic integrity is taken very seriously and violations are treated gravely. Academic integrity essentially means when you are responsible for a task, you will perform that task yourself. When you rely on someone else's work in an aspect of the performance of that task, you will give full credit in the proper, accepted form. In particular, when you are writing a paper, you must give credit to the works/sources that you have used directly.

   Furthermore, discussion and debate are encouraged in this course, with the firm expectation that all aspects of the class activities will be performed with great respect toward differing ideas, perspectives, and traditions. The students are encouraged to seek guidance when they are in doubt.

10. **Students with disability** If you are a student with a disability and you need academic accommodations, please see me and contact the Office of Disability Resources at 703/993-2474. All academic accommodations must be arranged through that office.

11. **General philosophy:** You should participate in all lectures and take your own notes. Listening to the lectures and participating in discussions will help you a lot. For exam preparation, you should read the book chapters in the lecture, review all lecture notes, consider discussions during the lectures, and study your problem sheets (homeworks) extensively. As this is a graduate level course, it is also expected that students independently review lecture notes and sections of the text book and prepare themselves for the lectures. Students are expected to review the necessary mathematical prerequisites for the course.