

Classical Mechanics I

Classical Mechanics:	Physics 350a/Applied Maths 353a
Lecturer:	Prof. Martin Houde houde@astro.uwo.ca http://www.astro.uwo.ca/~houde
Location:	Room 36, Physics and Astronomy Building
Lectures:	Monday, Wednesday, and Friday from 10:30 to 11:30
Recommended text:	Classical Dynamics of Particles and Systems , 5 th edition (Brooks/Cole), from S.T. Thornton, and J.B. Marion
Useful references:	See the bibliography below

Contact information:

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I can be reached at my office, especially after class where I will do my best to reserve time to answer your questions. I can also be reached during the week through e-mail for simple inquiries, or to make an appointment. I will reply to e-mails within two working days of reception.

Students should regularly check my website to find out about course material or announcements (at <http://www.astro.uwo.ca/~houde/courses/physics350a.html>).

Prerequisites: Physics 020 or 024 or 026 or the former 025. Calculus 251a/b and Linear Algebra 040a/b, or the former Applied Mathematics 200 and 213b.

Evaluation: The course will contain regular assignments, a mid term exam, and a final exam, worth 30%, 30%, and 40% of your final mark, respectively. *No electronics equipment (e.g., calculators, computers, etc.) will be allowed during the exams unless explicitly authorized ahead of time.* Students absent

on an examination day may be allowed to take a make-up exam if they present a note from a medical doctor within a reasonable amount of time. Similar consideration may be given under other exceptional circumstances.

Assignments: You will receive *four* lists of suggested problems during the semester, usually one every two to three weeks. I will indicate, for each list, which solutions of problems should be turned in for your assignments. Some of these problems may be chosen as material for the exams. Students are encouraged to discuss the material amongst themselves, *but every student is required to turn in a copy for each assignment (written on his/her own)*. Assignments must be turned in at the requested date. However, a student may miss a due date *once* during the semester, and hand in the late assignment on the day of the following lecture without incurring any penalty. Otherwise, for *every day* for which they are late, assignments will automatically have a third of the maximum number of points subtracted from their total.

Plagiarism: Students must write their assignments on their own. Whenever students take an idea, or a passage, or a solution to a problem from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. Plagiarism is a major academic offence (see Scholastic Offence Policy in the Western Academic Calendar)

Description

This course is intended to provide the student with the necessary tools to tackle more complex problems than those usually covered in introductory mechanics. Although the contents of the course will often require some degree of sophistication in the development of the theoretical formalism, numerous examples and problems will be used throughout to help the students grasp the underlying physics. It is assumed that the students are familiar with calculus-based physics, integral and differential calculus, and matrix algebra.

Course Outline

1. Review of Newtonian mechanics
2. Oscillations
3. Calculus of variation
4. Lagrangian and Hamiltonian dynamics
5. Central-force motion
6. Dynamics of a system of particles
7. Non-inertial reference frames
8. Dynamics of rigid bodies
9. Coupled oscillations
10. Special relativity (if time permits)

Important Dates

The assignments will be due on the following dates:

1st assignment:	<i>September 26</i>
2nd assignment:	<i>October 12</i>
3rd assignment:	<i>November 9</i>
4th assignment:	<i>November 28</i>

The *Mid-term Exam* will be held on *October 19*, early in the evening. This exam will last for two hours.

The *Final Exam* will be scheduled at a later date.

Bibliography

1. **Classical Dynamics of Particles and Systems**, S.T. Thornton, and J.B. Marion, 5th edition (Brooks/Cole). *This is the primary book for this class. An excellent text that covers a large amount of material. The explanations and demonstrations are usually easy to follow.*
2. **Classical Mechanics**, H. Goldstein, C.P. Poole, and J.L. Safko, 3rd edition (Addison Wesley). *A classic on the subject. Covers more material than Marion, and at a higher level. It is not always easy to follow.*
3. **Mechanics (Course of Theoretical Physics)**, L.D. Landau, and E.M. Lifshitz, 3rd edition (Butterworth-Heinemann). *Another classic, part of the series of books from this famous Russian duo. It is short and concise, and, therefore, has a tendency to "skip" steps in demonstrations. Not the easiest text to follow, but one from which you seem to learn more each time you go back to it.*
4. **Classical Dynamics**, D.T. Greenwood (Dover). *Somewhat advanced, but offers an excellent treatment of Lagrangian and Hamiltonian dynamics. It also includes a chapter on relativity. It has the great advantage of being relatively inexpensive.*
5. **Introduction to Classical Mechanics**, A.P. Arya, 2nd edition (Prentice-Hall). *A good book that covers the same material as Thornton and Marion, at about the same level. One of its dominant characteristics is that it puts a lot of emphasis on the use of computers (i.e., Mathcad) as a learning tool, and to solve problems.*
6. **Classical Dynamics: A Contemporary Approach**, J.V. Jose (Cambridge). *A recent book with a modern view on the subject. The author uses the geometrical approach (i.e., differential geometry). We will rarely (if ever) refer to this text (although it is quite good).*

7. **Newtonian Mechanics (The M.I.T. Introductory Physics Series)**, A.P. French, (Norton). *It is sometime a good thing to go back to introductory texts ... an excellent book on the fundamentals of Newtonian mechanics. Its aim is below the level of our course, but it can be a useful source for simple physical explanations to fundamental questions.*