Classical Mechanics I

Classical Mechanics: Physics 3151/ Applied Math 3151

Lecturer: Prof. Andrea Soddu

Lecture times MWF 10:30-11:20 am in Physics and Astronomy Building 117
(PAB 117).

Recommended text: Classical Dynamics of Particles and Systems,
5th edition (Brooks/Cole), from S.T. Thornton, and J.B. Marion
Useful references: See the bibliography below

Contact information:
Andrea Soddu
Assistant Professor
Department of Physics and Astronomy
Room 122, Physics and Astronomy Building
E-mail: asoddu@uwo.ca
Phone: (519) 661-2111 x82669 (office)

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.

Prerequisite(s): (Physics 1028A/B or 1301A/B or 1401A/B or 1501A/B) and (Physics
1029A/B or 1302A/B or 1402A/B or 1502A/B), or the former Physics 1020 or 1024 or
1026; Calculus 2303A/B or 2503A/B, Mathematics 1600A/B or the former Linear
Algebra 1600A/B.
Anti-requisites: none.

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 problems during the semester, usually one every two
weeks.
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. Continuous System Waves or Nonlinear oscillations and Chaos (if time permits)

Important Dates

The Mid-term Exam will be held on October 20, 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).

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.

ACADEMIC INTEGRITY:

Scholastic Offences

Scholastic offenses are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offense, at the following Web site: http://www.uwo.ca/univsec/handbook/appeals/scholastic_discipline_undergrad.pdf

Cheating

Cheating refers, among other things, to access to exam and assignment solutions by illicit means, including theft from other students, copying from other students, illegal access to instructor notes, inappropriate extraction from the world-wide-web, and illegal coercion of teaching assistants and other staff. The definition of cheating is not restricted to these examples, and may be interpreted more broadly at the instructor's discretion. If two submitted assignments are identical, or almost identical, both will be given a grade of zero. Assignment solutions should be distinctively individual.

Acknowledging Sources in Assignments

Whenever students obtain auxiliary information from any source (books, world-wide-web, etc.), they must acknowledge their debt by proper referencing such as footnotes or citations.

Classroom Conduct

Disruptive behaviour will not be tolerated in class. Please respect the rights of your classmates to benefit from the lecture by limiting your conversations to those essential to the class. Students who persist in loud or rude behaviour will be asked to leave.

MISCELLANEOUS UNIVERSITY REGULATIONS:

Accommodations for Religious Holidays

When scheduling unavoidably conflicts with religious holidays which a) require an absence from the University or b) prohibit or require certain activities (i.e., activities that would make it impossible for the student to satisfy the academic requirements scheduled on the day(s)

involved), no student will be penalized for absence because of religious reasons, and alternative means will be sought for satisfying the academic requirements involved. If a suitable arrangement cannot be worked out between the student and instructor involved, they should consult the appropriate department chair

and, if necessary, the student's Dean. It is the responsibility of such students to inform themselves concerning the work done in classes from which they are absent and to take appropriate action. A student who, for either of the situations outlined in paragraph one above, is unable to write examinations and term tests on a Sabbath or Holy Day in a particular term shall give notice of this fact in writing to his or her Dean as early as

possible, but not later than November 15 for mid-year exams and March 1 for final exams (i.e., approximately two weeks after the posting of the mid-year and final examination schedule respectively). In the case of mid-term tests, such notification is to be given in writing to the instructor within 48 hours of the announcement of the date of the mid-term test. If a Special Examination is offered as an alternative means to satisfy the academic requirements, the instructor(s) in the case of mid-term tests and the dean in the case of mid-year and Spring final examinations will arrange for special examination(s) to be written at another time.

The accommodation must occur no later than one month after the end of the examination period involved. It is mandatory that students seeking accommodations under this policy give notification before the deadlines and that Faculty accommodate these requests. For purposes of this policy the University has approved a list of dates which are recognized religious holidays which require members of those religions to be absent from the University; this list is updated annually and is available at Departmental, Deans' and Faculty advising offices.

Make-up Policy

If you are unable to meet a course requirement due to illness or other serious circumstances, you must provide valid medical or other supporting documentation to the Dean's office as soon as possible and contact your instructor immediately. It is the student's responsibility to make alternative arrangements with their instructor once the accommodation has been approved and the instructor informed. In the event of a missed final exam, a "Recommendation of Special Examination" form must be obtained from the Dean's Office immediately. For UWO Policy on Accommodation for Medical Illness, see:

http://www.uwo.ca/univsec/handbook/appeals/accommodation_medical.pdf.

A student requiring academic accommodation due to illness should use the Student Medical Certificate [see https://studentservices.uwo.ca/ under the Medical Documentation heading for a downloadable SMC] when visiting an off-campus medical facility, or request a Records Release Form (available in the Dean's Office) for visits to Student Health Services. Students seeking academic accommodation on medical grounds for any missed tests, exams, participation components and/or assignments worth 10% or more of their final grade must apply to the Academic Counselling office of their home Faculty and provide documentation. Academic accommodation cannot be granted by the instructor or department.

Final Examination

In accordance with Senate Policy, a Special Examination will be held within thirty days of the regular final examination for students who are unable to write the regular examination for medical or other documented reasons. Requests for such a Special Examination must be made to the Associate Dean, Faculty of Science. Note that if you fail to write a scheduled Special Examination, permission to write another Special

Examination will be granted only with the permission of the Dean in exceptional circumstances and with appropriate supporting documents. In such a case, the date of this Special Examination normally will be the scheduled date for the final exam the next time the course is offered.

Accessibility

Services for Students with Disabilities (SSD) works with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. Please contact the course instructor if you require material in an alternate format or if you require any other arrangements to make this course more accessible to you. You may also wish to contact the SSD at 661-2111 ext. 82147 for any specific question regarding an accommodation.

Complaints and Suggestions

If you have any concerns, please let us know. We rely on your feedback. Please contact initially the person most directly concerned; this will usually be your instructor. If that is not satisfactory, or if there is something more general bothering you, talk it over with the Physics & Astronomy Department Chair or the Associate Chair of Undergraduate Studies (for contact information see http://www.physics.uwo.ca