PHYS 321B – Classical Mechanics II
Course Outline: Jan 2020 – Apr 2020

Instructor: Dr. M. Laidlaw
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Lectures: 8:30 – 9:30 TWF, ELL 160
Office Hours: I will post office hours on the PHYS 321B “CourseSpace” site.

Prerequisite: PHYS 321A.
Concurrent enrolment or prior completion of both MATH 342 and 346. This course will be mathematically demanding; I assume that all students have a strong basis in calculus and vector algebra.

Strongly Recommended Texts:
Landau & Lifshitz, Mechanics, 3rd Edition
Goldstein, Poole, & Safko, Classical Mechanics, 3rd Edition
Both are classic high-level texts that will be excellent references for your future studies.

Calendar Description:
Rigid body dynamics, an introduction to analytical mechanics including Lagrange’s and Hamilton’s equations, theory of small oscillations.

Course Content approximately by week:

1. Principle of Least Action and Calculus of Variations
2. Lagrangian Mechanics and Lagrange’s Equations of Motion.
3. Generalized coordinates, coordinate transformations, and tensors.
4. Constraints, degrees of freedom, and forces of constraint.
6. Central forces and scattering.
7. Rotational dynamics.
8. Symmetric top and torque-free rotation.
10. The continuum and Lagrangian Densities.
11. Hamiltonian Mechanics and Hamilton’s Equations of Motion
12. Coordinate transformations and the Poisson Bracket.
Organizational Details:

Midterm Exams:
There will be an in-class midterm exam on **February 25**.
The midterm exam will be held in **TBD**.

Final Exam:
There will be a final exam during the April exam period.
The date is centrally scheduled, and normally finalized in late February.
Do not plan April or Summer travel before you know the exam schedule.
You must write the final exam to get credit for this course.

Course Material:
I will distribute any course material via the “CourseSpaces” site for PHYS 321B, 
available at coursespaces.uvic.ca. This will include guidance on which textbook 
sections to read.

Assignments:
Assignments will be assigned and due approximately weekly or biweekly.

Lab and Computational Assignments:
I will give you instructions about data to collect and analyses to undertake. The 
data collected will be separate from the regular labs, and the exercises anticipate 
that the data will be relatively quick to obtain.

Accommodations:
I am willing to arrange reasonable accommodations for customarily 
accommodated issues, however this is contingent on your active participation in 
the course and the accommodation process. My decisions will be partially 
informed by criteria such as attendance and assignment submission. If you miss a 
course requirement, I expect you to contact me as soon as reasonably possible, 
and I expect you to give me advance warning of issues that you could have 
reasonably foreseen. I will only consider “last minute” requests due to sudden or 
exceptional circumstances, and I will not consider requests made an unreasonable 
amount of time after the issue or deadline.

Labs:
Lab sections are normally held in Elliott 125. Labs start January 6. 
You must complete all labs and pass the labs to obtain credit for the course.
No student will be granted exemption from the labs. 
You will be given scheduling information at the first lab. I expect you to organize 
a balanced schedule that roughly includes 1 lab per month. 
The due date for any experiment report is normally in the lab period one week 
after the experiment has been completed. You may not undertake an experiment 
if you have not handed the experiment report for a previous experiment. 
No reports will be accepted after April 3.
Marking and Grades:

The skills you must demonstrate in this course include

1. Calculation of, and solution of equations of motion for a system of objects using the Lagrangian formulation.
2. Calculation of, and solution of equations of motion for a system of objects using the Hamiltonian formulation.
3. Identification and application of conservation laws to motion problems.
4. Application of mechanical principles to small oscillations and small perturbations.
5. Application of mechanical principles to rotating rigid objects.
6. Application of mechanical principles to central force and scattering problems.
7. Other applications of the material taught in class and outlined in the text.

Examinable material includes everything discussed in class, in the assigned readings, and topics I think you should be able to deduce from those.

Grades will be assigned in accordance with the narrative descriptions in the undergraduate calendar, found here:
http://web.uvic.ca/calendar2019-09/undergrad/info/regulations/grading.html#

Exams:

For individual questions:

- Students exhibit B-range performance by competently formulating the posed problem mathematically and proceeding, using techniques from class, to attempt to solve the problem. Typical problems include mechanical calculation errors, omission of a relevant term, inappropriate approximations, and “getting lost” near the solution.

- Relative to B-range performance, A-range performance is characterized by only minor errors and a much more complete solution. In the event of an error at an early point in calculation A-range work drives through to a (wrong) solution. A+ level work could be exhibited as the solution.

- Relative to B-range performance, C and D-range performance is characterized by significant mathematical or conceptual deficiencies in the attempted, or the inability to proceed past the competent mathematical formulation of the posed problem.

- Inadequate performance (F-range) is characterized by the inability to formulate the posed problem, or superficial and mathematically deficient attempt at the problem.

For exams as a whole:

- Exams will normally include some choice about questions to answer, and will be accompanied by a rubric which will specify the number of questions which need to be answered at a particular skill level to attain a particular grade for the exam.

- To attain at least D-range performance on the final exam, students will be required to exhibit B-range performance or better on skills #1 and #2 listed above.
Problem sets:

- Students exhibit B-range performance on problems sets by submitting substantially appropriate (at least B-level, as defined for exam) solutions to almost all posed problems on problem sets. A rough benchmark for “almost all” is over 85%.
- Relative to B-range performance, students exhibit A-range performance by submitting higher quality solutions, and omitting less work.
- Students exhibit C- or D-range performance on problem sets by not exhibiting B-range performance. This means submitting inappropriate and incorrect solutions to a substantial part of the assigned questions or omitting a substantial fraction of the questions.
- Students exhibit F-range performance on problem sets by failing to submit solutions to problems sets, by systematically failing to answer all questions on a problem set, by submitting illegible or hard-to-follow solutions, and by frequent late submission of their problem sets. Students who submit less that 60% of the assigned work may be considered to exhibit F-range performance.
- Note that questions that require you to program are considered part of the problem sets.

Labs:

- Students exhibit A- or B-range performance in the labs by completing the assigned task competently within the time allotted and producing an appropriate report. A-range work is characterized by fewer calculational problems and more detailed original insight.
- Students exhibit C- or D-range performance through work which has significant calculational or procedural flaws, which omits a small part of the required work, or which is submitted shortly after the deadline.
- Students exhibit inadequate (F-range) performance by combining missing work with significant flaws, by failure to take appropriate care with the laboratory equipment, or by submitting a lab report significantly after the deadline.

Lab and Computational Exercises:

- Students exhibit B-range performance by submitting work that reasonably addresses, using the techniques from class, the questions and instructions for almost all (as defined above) the lab exercises. The work submitted should not be obviously inconsistent with well-known principles.
- Students exhibit A-range performance by submitting work that is more technically competent and insightful than B-range work.
- Students exhibit C- or D-range performance by submitting work that only superficially addresses the exercises or has clear inconsistencies.
- Students exhibit F-range work by submitting work that only superficially addresses the instructions and questions in the lab exercises, or by failing to submit the some of the exercises.
Grading:

<table>
<thead>
<tr>
<th>Component</th>
<th>Weightage</th>
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<tbody>
<tr>
<td>Midterm</td>
<td>10%</td>
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<tr>
<td>Labs</td>
<td>15%</td>
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<tr>
<td>Lab and Computational Exercises</td>
<td>15%</td>
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<tr>
<td>Assignments</td>
<td>20%</td>
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<tr>
<td>Final</td>
<td>40%</td>
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To determine your grade, I will combine my assessment of your performance in each of the assessed components subject to the weighting explained above to determine the appropriate grade category for you (A+ through F). Once I have determined the appropriate category I will assign, as your percentage grade, a percentage that corresponds to that letter grade. I usually assign the same percentage to all students receiving the same letter grade – the grade categories where I may elect to assign different percentages are F, D, and A+.

I will use my academic judgment and the narrative descriptions described to choose an appropriate category in the case that the marks in the different categories are not obviously consistent.

Notwithstanding the weighting and procedure explained above:

- If you do not write the final exam I will assign an “N”.
- If you exhibit inadequate performance on the final exam I will assign an “F”.
- If you exhibit inadequate performance on the labs I will assign an “F”.
- If you exhibit marginal (D-range) performance on the final exam the maximum mark I will assign is a “D”.
- If you exhibit inadequate performance on either the assignments or the lab and computational exercise the maximum mark I will assign is a “D”.
- I will not assign a grade “B” or above to any student who has not shown at least B-range performance on the Final exam, the Assignments, and the Lab and Computational Exercises.