

## PHYS 321B – Classical Mechanics II

### Course Outline: Jan 2026 – Apr 2026

Instructor: Dr. M. Laidlaw  
Office: Elliott 106  
Phone: 721-7701  
Email: [laidlaw@uvic.ca](mailto:laidlaw@uvic.ca)

Lectures will occur TWF 8:30-9:20

There will not be an opportunity to do exams or labs remotely.

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, and a degree of competence programming in Python.

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. Jan 5 – Principle of Least Action and Calculus of Variations
2. Jan 12 – Lagrange's Equations of Motion
3. Jan 19 – Forces of Constraint
4. Jan 26 – Small Oscillations and Normal Modes I
5. Feb 2 – Small Oscillations and Normal Modes II
6. Feb 9 – Scattering and Conservation
7. Feb 23 – **Midterm** and Finish Scattering and Conservation
8. Mar 2 – Rotational Motion I
9. Mar 9 – Rotational Motion II
10. Mar 16 – Hamiltonian Mechanics I
11. Mar 23 – Hamiltonian Mechanics II
12. Mar 30 – Tensors and wrapping up

## **Organizational Details:**

### **Midterm Exam:**

There will be an in-person midterm exam on Feb 24.

### **Final Exam:**

There will be an in-person final exam during the April exam period. The final exam is the essential course element.

### **Course Material:**

All posted material will be available via the UVic LMS Brightspace.

### **Assignments:**

There will be regular (approximately weekly) assignments.

### **Computational Assignments:**

There will be several computational assignments which will require programming in a language such as Python to produce output relevant to our course material. I anticipate that there will be 4-6 such assignments. Some class time may be devoted to these.

### **Accommodations and Academic Concessions:**

I am willing to make reasonable arrangements for issues that need to be addressed consistent with custom and discipline norms. 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, Assignments, and Computational Assignments may not be deferred past the end of the lecture period (Apr 2)

### **Labs:**

Labs will be in person.

There will be an introductory session during the week of Jan 5-9.

You must complete all labs and exhibit satisfactory performance in the labs to obtain credit for the course. You are expected to submit your lab work in a timely fashion, respecting the customary deadlines. If you do not submit your lab work in a timely manner I may contact you and impose a final deadline for that work.

I take Academic Integrity in this course extremely seriously.

You can find UVic's Policy on Academic Integrity in the Calendar; [here is a link](#).

You can also find the Faculty of Science's [Student Code of Conduct here](#).

In overview, your responsibilities are:

- You must complete all work on exams on your own without help from another person or from outside sources.
- You must submit only your own original work for the labs. You may seek help or advice from me, your lab instructor, or from another student. You may not copy or paraphrase from another student. You may not permit your work to be copied or paraphrased by another student.
- You must undertake the work on assignments by yourself. You may seek advice or help from me, other students, or other people, but you are responsible for undertaking and understanding the work you submitted. You may not copy or paraphrase from another person. You may not permit your work to be copied or paraphrased by another student.
- You may not share or post course material that I have created without my express permission.
- You must engage respectfully with your peers and engage honestly and forthrightly with processes and procedures at the University.

## **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 both analytically and numerically.
5. Application of mechanical principles to rotating rigid objects both analytically and numerically.
6. Application of mechanical principles to central force and scattering problems both analytically and numerically.
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](#).

You should note that the narrative descriptions of the grade ranges indicate:

A-range grades are earned by technically superior work which shows mastery of the subject.

B-range grades are earned by work which shows good comprehension, command of course skills, and full engagement with the course material.

C or D-range grades are earned by work which show adequate or minimal comprehension of course material, or minimal acceptable participation.

F indicates work that is inadequate and unworthy of credit.

What this means is that in grading I make two determinations:

1. I assess the quality of your work, and
2. I assess the level of your engagement.

I will assess your engagement as follows:

- Full engagement means completing all labs, completing essentially all assignment questions (~90%), and completing essentially all computational questions.
- Basic engagement means completing all labs, completing most assignment questions (~70%), and completing most computational questions.
- Minimal participation means completing two labs, completing half the assignment questions, and completing half the computational problems.

**Full engagement is required for a grade in the A or B range, minimal participation is required for a passing grade.**

**Individual questions on class work or exams are marked on a 0 to 4 ordinal scale. These definitions form the basis for the grades in the exam and assignment elements:**

4 – Indicates that the question is answered clearly and that the answer is technically correct using techniques and concepts from class. There are no discernable problems with the mathematical exposition. The work has clear and appropriate written explanations and diagrams. The work is comparable in quality to the solution set.

3 – Indicates that the work is broadly correct in addressing the question using techniques and concepts from class. The work competently attempts to address the posed question. There may be small mathematical errors or omissions. There may also be defects in the written exposition such as poor explanations or unclear diagrams. The errors, omissions, and defects do not undermine the marker's inference that the writer understands the solution of the problem.

2 – Indicates work that competently uses techniques or concepts from class to attempt to solve the question. The work does not reach the correct answer because of calculational errors, inappropriate approximations, or similar issues, but the work shows meaningful and appropriate effort to apply the reasoning methods taught in class.

1 – Indicates work which has significant conceptual or mathematical deficits in the attempt to solve the question. This category includes being unable to meaningfully proceed past the mathematical formulation of a question.

0 – Indicates work which is not submitted, that is unable to formulate the posed problem mathematically, that does not use techniques and concepts from class, or that makes mathematical claims that are not appropriately supported by the work presented. This category includes all forms of question-begging including “mathematical miracles” which take incorrect work and transform it into the expected answer.

A note about negative signs, numerical prefactors, and notation: In mathematical derivations these are common places for errors to occur. Sometimes those errors are inconsequential, and sometimes those errors communicate a significant lack of understanding. It is my job in marking to determine which is which; getting the sign wrong when you write a Hamiltonian makes it look like you can't distinguish between it and a Lagrangian, and using the wrong variables has a similar effect.

**I will determine a letter grade based on the UVic scale for each of the five marked components: Final Exam, Midterm Exam, Assignments, Computational, Labs**

**Final Exam:**

A-range – indicates work of at least the “3” level in skills 1&2 listed, and demonstrates a broad capability of at least the “2” level in all skills listed. The bulk of the work will be at the “3” level.

B-range – indicates work of at least the “3” level in skills 1&2 listed, and demonstrates capability of at least the “2” level in at least two skills from skills 3—6.

Passing – indicates work of at least the “2” level in skills 1&2, and demonstrates capability of at least the “2” level in at least one skill from skills 3—6. Some of the work must be at the “3” level.

Failing – indicates work which does not meet the “2” level in skills 1&2 or work that does not meet the “3” level in any of the skills listed.

#### **Midterm Exam:**

A-range – indicates work of at least the “3” level across the whole exam OR A-range work on the final exam.

B-range – indicates work of at least the “3” level in skill 1 and work across the exam of at least level “2” OR B-range work on the final exam.

Passing – indicates work of at least the “2” level in skill 1 together with some other work at level “2” OR passing work on the final exam.

Failing – indicates either work which does not meet the “2” level in skill 1, or that the midterm exam was not written AND failing work on the final exam.

This scheme replaces your midterm grade by the final grade if the final is higher.

#### **Assignments and Numerical Work:**

A-range – indicates work of at least the “2” level on essentially all assigned problems, with the vast majority of the “3” level or higher.

B-range – indicates work of at least the “2” level on essentially all assigned problems, with over half of the “3” level or higher.

Passing – indicates work of at least the “2” level on a significant majority of all assigned problems.

Failing – indicates work below the “2” level on approaching half the assigned problems.

#### **Labs:**

A-range – all labs completed promptly and an average score over 80% assigned.

B-range – all labs completed and an average score over 70% assigned.

Passing – at least two labs completed and an average score over 50% assigned.

Failing – at least two labs completed and an average score under 50% assigned.

N – at least two labs not completed.

To determine your grade I will average the letter grades on the course components equally weighted subject to the following:

- A-range grade requires full participation, A-range grade on the final, and Passing grade on the labs.
- B-range grade requires full participation, B-range or better grade on the final, and Passing grade on the labs.
- C-range grade requires at basic participation or better, Passing or better grade on the final, and Passing grade on the labs.
- D requires minimal participation or better, Passing or better grade on the final, and Passing grade on the labs.
- F results from Failing grade on the final or Failing grade on the labs.
- N results from not completing at least two labs or from not writing the final.