Classical Mechanics

PHY C54 - Fall 2019

Lecture	Wednesday	12:00 pm - 2:00 pm	IC 320
Tutorial	Tuesday	12:00 pm - 2:00 pm	HW 408

Instructor: Johann Bayer
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Office Hours

Tuesday	9:30 am - 11:30 am	
Wednesday	9:30 am - 11:30 am	2:30 pm - 4:30 pm
Thursday	9:30 am - 11:30 am	12:30 pm - 2:30 pm

Course Description and Requirements

A course that will concentrate in the study of symmetry and conservation laws, stability and instability, generalized co-ordinates, Hamilton's principle, Hamilton's equations, phase space, Liouville's theorem, canonical transformations, Poisson brackets, Noether's theorem.

By the end of the course you will be able to:

- Identify and define the basic vocabulary used in Lagrangian and Hamiltonian Mechanics and employ related variational methods to study mechanical systems.
- Apply the fundamental principles of Lagrangian Mechanics to the description of systems in noninertial frames of reference and to the analysis of the motion of rigid bodies.
- Continue building a mathematical toolbox connected to quantitative and analytical skills useful to the scientist in general, and to the physicist in particular.

Course Prerequisites: Mechanics: Oscillations to Chaos (PHYB54); Differential Equations I (MATB44)

Required Materials

- **Textbook:** ***Classical Mechanics*** by John R. Taylor (University Science Books 2005)

The schedule provided at the end of this document indicates the chapters and sections you must read **before** each lecture. The textbook also provides the conceptual questions and detailed problems that will be the subject of the weekly problem sets and tutorial quizzes.

- **Calculator:** A scientific non-programmable calculator is required.

Grading Scheme

Component	%	Due Date
Reading Quizzes	5	Ongoing (Pre-Lecture)
Tutorial Work	15	Ongoing (Weekly Tutorials)
Test #1	15	Week 5 (Tentative)
Test #2	20	Week 9 (Tentative)
Final Examination	45	Exam Period (December 06 - 21)

Grade Components

Reading Quizzes (5%)
Each week on the course website you will be asked a set of questions from the assigned readings for the upcoming week. You will have until **09:55 am** on **Wednesday** to submit your answers. Each quiz is worth **5 points**, and your final grade is the total sum of all quizzes up to a maximum of **50 points**. Use the **Class Schedule** found at the end of this document to prepare for the lectures and reading quizzes.

Tutorial Work (15%)
During the tutorials we will discuss the most important points in the problem sets as well as difficult points you may have encountered in your readings. Please note that the problem sets will not be collected or graded and it is your responsibility to make sure you understand the discussions presented in these problems. The assessment of your work will be a combination of tutorial quizzes, group work, blackboard problems, electronic homework, and take-home questions.

Test #1 (15%)
This **90-minute** long test will be scheduled during **Week 5**. Content includes all lecture discussions, textbook readings, and problem sets up to and including the material assigned and discussed in Week 4.

Test #2 (20%)
This **2-hour** long test will be scheduled during **Week 9**. Content includes all lecture discussions, textbook readings, and problem sets up to and including the material assigned and discussed in Week 8.

Both tests will include conceptual questions in multiple-choice or short-answer format, and detailed problems. The only aids allowed are your non-programmable scientific calculator, and a hand-written, double-sided, and letter-sized aid sheet that may not include explicit problem solutions. Photocopies or computer printouts are not allowed.

Final Examination (45%)
The final examination will be scheduled during the exam period of **December 06 - 21**. Content for the final examination includes all the topics discussed in the assigned textbook readings, problem sets, and tutorial work. The final examination will be **3 hours** long and the format includes conceptual multiple-choice and short answer questions as well as detailed problems. The only aids allowed are your non-programmable scientific calculator, and a hand-written, double-sided, and letter-sized aid sheet that may not include explicit problem solutions. Photocopies or computer printouts are not allowed.

Class Policies

Email Communications
If you want to ask a question via email, please first check the various threads in the Discussions section of the course website. Quite likely, you are not the only person with that same question, and if that question has already been asked, you will find the answer there. If the question has not been asked, go ahead and post it yourself instead of sending it by email. This way you will also help other students facing the same issue. These discussions are monitored regularly by the course instructor and your peers, making it the best way of communicating for various queries of a diverse nature.

However, if these electronic forums are not the best place for your query, make sure you send your email from an official **utoronto.ca** address (e.g., your UTmail+ account), as all other addresses will be filtered out automatically. For a quicker response time include the code **PHYC54** in the subject line of your message. I reply to emails within a period of 24 hours and I rarely reply to emails during weekends.

Absences

In the case of a **valid** and **documented** problem that supports an absence to a tutorial, the grade will be calculated on the basis of all other work. In the case of a **valid** and **documented** problem that supports an absence to the first test, the second test will have its weight increased accordingly. In the case of a **valid** and **documented** problem that supports an absence to the second test, the final examination will have its weight increased accordingly. If the problem is health-related use the official form: http://www.utsc.utoronto.ca/∼registrar/resources/pdf_general/UTSCmedicalcertificate.pdf

Name and Student Number

Any work you hand in must clearly indicate your name and student number, this includes tutorial quizzes, tests, and the final exam. Any work you submit that fails to meet this requirement will be penalized with a 10% deduction, provided we are able to identify the work as yours. If we are unable to identify the work as yours, a grade of zero will be awarded.

In-class Conduct

- Lectures and tutorials start at 12:10 pm and end at 2:00 pm. Late arrival or early departure from class is inappropriate, disruptive, and will negatively affect the learning environment.
- Regarding anything that you want to use in the classroom: if you are not using it to perform a task specifically related to what we are doing in class at that very moment, you must put it away. This includes but is not limited to cell phones, laptop computers, tablets, and other electronic devices.
- Do not bring or consume food in the classroom as this creates unwanted distractions that will negatively affect the learning environment. Be considerate to your peers.

Academic Integrity and Respect for the Academic Endeavor

Academic integrity is essential to the pursuit of learning and scholarship in a university, and to ensuring that a degree from the University of Toronto is a strong signal of each student's individual academic achievement. As a result, the University treats cases of cheating and plagiarism very seriously. The University of Toronto's *Code of Behaviour on Academic Matters:*

https://governingcouncil.utoronto.ca/media/15068/view

outlines the behaviours that constitute academic dishonesty and the processes for addressing academic offences. Potential offences include, but are not limited to:

- In papers and assignments: Using someone else's ideas or words without appropriate acknowledgment; submitting your own work in more than one course without the permission of the instructor; making up sources or facts; obtaining or providing unauthorized assistance on any assignment.
- On tests and exams: Using or possessing unauthorized aids; looking at someone else's answers during an exam or test; misrepresenting your identity.
- In academic work: Falsifying institutional documents or grades; falsifying or altering any documentation required by the University, including (but not limited to) doctor's notes.

All suspected cases of academic dishonesty will be investigated following procedures outlined in the *Code of Behaviour on Academic Matters*. If you have questions or concerns about what constitutes appropriate academic behaviour or appropriate research and citation methods, you are expected to seek out additional information on academic integrity from your instructor or from other institutional resources (see https://www.utsc.utoronto.ca/vpdean/academic-integrity).

Course Support

Access*Ability*

Students with diverse learning styles and needs are welcome in this course. In particular, if you have a disability/health consideration that may require accommodations, please feel free to approach me and/or the Access*Ability* Services Office as soon as possible. I will work with you and Access*Ability* Services to ensure you can achieve your learning goals in this course. Enquiries are confidential. The UTSC Access*Ability* Services staff (located in SW302) are available by appointment to assess specific needs, provide referrals and arrange appropriate accommodations (416) 287-7560 or ability@utsc.utoronto.ca

Class Schedule

This schedule is ***tentative*** and might change during the term in order to accommodate for variations in the lectures in response to performance and feedback from the students. Some topics might be removed and others added to adjust for variations in the background of the class. Announcements will be made whenever needed.

Please note that it is your responsibility to read the assigned sections and chapters **before** each lecture. During the lectures we will concentrate on the most important and difficult aspects of the theories and concepts from your textbook readings. Failing to complete the textbook readings before each lecture will negatively affect your ability to understad and participate in the class discussions.

Dates	**Tuesday Tutorial** 12pm - 2pm	**Wednesday Lecture** 12pm - 2pm
Sep. 03	**Calculus of Variations**	**Calculus of Variations**
Sep. 04	Chapter 6: 1 - 2	Chapter 6: 2 - 4
Sep. 10	**Problem Set # 01**	**Lagrange's Equations**
Sep. 11	Tutorial #01	Chapter 7: 1 - 4
Sep. 17	**Problem Set # 02**	**Lagrange's Equations**
Sep. 18	Tutorial #02	Chapter 7: 5 - 8
Sep. 24	**Problem Set # 03**	**Hamiltonian Mechanics**
Sep. 25	Tutorial #03	Chapter 13: 1 - 4
Oct. 01	**Problem Set # 04**	**Hamiltonian Mechanics**
Oct. 02	Tutorial #04	Chapter 13: 5 - 7
Oct. 08	**Problem Set # 05**	**Mechanics in Noninertial Frames**
Oct. 09	Tutorial #05	Chapter 9: 1 - 3
Oct. 15	**Problem Set # 06**	**Reading Week**
Oct. 16	Computational Homework	**Reading Week**
Oct. 22	**Problem Set # 07**	**Mechanics in Noninertial Frames**
Oct. 23	Tutorial #07	Chapter 9: 4 - 7
Oct. 29	**Problem Set # 08**	**Mechanics in Noninertial Frames**
Oct. 30	Tutorial #08	Chapter 9: 8 - 10
Nov. 05	**Problem Set # 09**	**Rotational Motion of Rigid Bodies**
Nov. 06	Tutorial #09	Chapter 10: 1 - 3
Nov. 12	**Problem Set # 10**	**Rotational Motion of Rigid Bodies**
Nov. 13	Tutorial #10	Chapter 10: 4 - 7
Nov. 19	**Problem Set # 11**	**Rotational Motion of Rigid Bodies**
Nov. 20	Tutorial #11	Chapter 10: 8 - 10
Nov. 26	**Problem Set # 12**	**Continuum Mechanics**
Nov. 27	Tutorial #12	Chapter 16: 1 - 4