McGill University – Physics 131

("Mechanics and Waves")

Fall 2022 Session – General Course Information

(This document is posted on myCourses)

Document version v3 (final ?), 25-Aug-2022

Version v1 (preliminary): original; July 2022
Version v2 (preliminary): minor updates, August 2022
Version v3 (final ?): changes to ANS, tutorial descriptions, links 25-Aug-2022

Note: In the event of extraordinary circumstances beyond the University's control, the content and/or evaluation scheme in this course is subject to change.

Welcome to PHYS 131, a course of study in mechanics and waves, primarily intended for students in Science and Engineering.

Important note: This fall (2022), we currently (as of writing in August 2022) plan to be back in person, for both lectures and labs. The situation could conceivably change before the course starts in late August 2022. I encourage you to check myCourses where I will post updated versions.

Course learning goals and outcomes

The goal of this course is to give you a strong foundation in mechanics: the description of motion; forces and their effects; related quantities like momentum and energy and their conservation; rotational motion and dynamics; oscillations; and waves. This includes the underlying ("theoretical") concepts, but also extensive experience in ("practical") problem-solving: identifying, in a mechanical system, which (if any!) of these concepts applies, why that is so, and carrying out a quantitative analysis of the system.

In the mathematical models that we build for these systems, we will sometimes have recourse to ideas from calculus. The level of calculus will not be very high: initially some basic single-variable differentiation (ie, things like v = dx/dt to describe the velocity as the time derivative of the position) and, later in the course, some very basic integration.

The course is primarily aimed at students in the physical sciences and engineering.

Instructor, contact information

The instructor is:

Prof. Ken Ragan
Rutherford Physics Building, room 344
514-398-6518

email: ragan@physics.mcgill.ca

In all emails to me, please indicate PHYS 131 on the subject line, and include your name and ID number in the text of the message! Please do **not** use the myCourses or other email systems, since they don't permit me to respond easily and I don't monitor those email systems.

My **office hours** will probably be held as a combination of in-person and online sessions in the September 2022 term. Although there will be set times initially, if you can't make that time but would like to talk to me, feel free to email me and we can set up an appointment. **Please do NOT be shy about contacting me if you are having difficulties.**

Course components

The **course components** are:

- 39 in-person sessions ("**lectures**")
    - Mondays/Wednesdays/Fridays, 12:35 – 1:25 PM Montreal time
    - Wednesday, August 31, 2022 through Monday, December 5, with the following exceptions to a regular MWF schedule:
        - No class Monday, September 5 (Labour Day)
        - No class Monday, October 10 (Thanksgiving Day)
        - No class Wednesday, October 12 (Fall Reading Break)
        - CLASS on Thursday, October 13 (this day has a Monday schedule), but
        - NO CLASS on Friday, October 14 (which has a Tuesday schedule)
- (*) **Pre-lecture reading** and discussion activities, done online using the Perusall system
- (*) ~10 problem **assignments**, done online using the ANS system
- (*) 5 **laboratory sessions**, which are compulsory (the first will be online; the remaining four are done in-person)
- (*) a **midterm exam**, from 7 to 9:30 PM on **Tuesday, October 18**
- (*) a **final exam** written during the formal fall examination period in December

Evaluations/assessments

The **evaluation scheme** for the course is:

Item	Comments	Default weight (%)
Assignments	Online through ANS	15
Labs	Mandatory (>55%) to pass	20
Midterm exam	Tuesday October 18, evening	20 or 30 (*)
Pre-lecture reading & discussion	Online through Perusall	10
Final exam	In December exam period	35 or 25 (*)

(*) The weighting of the midterm and the final will be chosen in such a way, for you personally, as to give you the highest grade. That is, if you do better on the final than on the midterm (percentage-wise) then the final will receive the 35% weighting and the midterm will be weighted 20%. If the converse is true (that you do better on the midterm) then the final will be weighted 25% and the midterm 30%. This is done automatically, without any action necessary on your part.

The **assignments** are done weekly online with ANS (see below), available through myCourses.

The **discussion** points will be based on your participation in pre-lecture activities (readings, discussions) done through the Perusall © system (more details below), available through myCourses.

The **quiz and exam** formats have not yet been finalized, but in the past, exams have been a mix of conceptual questions (questions requiring short written answers) and problems requiring fully worked solutions.

After the calculation of your total course mark (out of 100), the standard McGill letter grade scale will be used (see www.mcgill.ca/study/2018-2019/university_regulations_and_resources/undergraduate/gi_grading_and_grade_point_averages); only the letter grade will be reported to you (and to Minerva).

Policy on missed assessments and regrading

Assessments which are missed are counted as zeros, unless you explicitly contact me and I agree to exclude that assessment.

However, for the Perusall pre-lecture reading and the ANS assignments, I will remove the lowest of your scores (ie, I will average the top N-1 out of N) automatically. Thus, there's no need to contact me if you have a one-off problem and can't make one of them (or simply don't do as well in it as you might have wished).

For all graded assessments, if you believe there is an error in the marking, then you must contact me (or, for labs, contact Lisa Rudolph lisa.rudolph@mail.mcgill.ca) within 96 hours of the grades being released to you. I (usually in concert with the graders) will review the grading and correct it if warranted. After the 96 hour period I will not entertain requests to review the grading in this informal way. However, there is also formal re-grade policy (see the link at the end of this document) available.

Given the importance of labs and the mid-term exam, if you miss one and don't want it to be a zero, you must contact me (or, for labs, Lisa Rudolph: lisa.rudolph@mail.mcgill.ca) with an appropriate (in our eyes) explanation and documentation.

Course material & textbooks

This course is about Newtonian physics, which was developed largely in the 1700's and 1800's. There are many textbooks on the market that contain this material (often the title will contain the words "University Physics" or equivalent to indicate that there is some calculus content – although we will use **little** calculus in this course). There are also several open-source textbooks with the same content, and we will use one (see below).

The **course material** will cover the following topics:

- Introduction, units, etc.

- 1-D kinematics
- Vectors & 2-D kinematics
- Dynamics
- Energy & Work
- Momentum & Collisions
- Rotational motion: kinematics, dynamics, energy, angular momentum
- Gravitation
- Oscillations & waves
- ~~Sound & wave optics (time permitting)~~

The textbook we will be following is **"University Physics"** from OpenStax; it's free and available online:

https://openstax.org/details/books/university-physics-volume-1

You can download the pdf file from that link or order a physical copy.

In the past I have used Serway & Jewett's "Physics for Scientists and Engineers" (10th edition) and the McGill bookstore has indicated to me that they will have some used copies for sale in Fall 2022. If you really want a luggable, physical textbook, this is a good option – but as indicated above, there are many other appropriate-level textbooks available.

Lectures, advance reading, course material

In Fall 2022, for the first time since Fall 2019, we will be back in-person, with live lectures in Leacock 132. The sessions will be recorded and posted on myCourses, but I strongly encourage your attendance, for reasons that I'll touch on in the first lecture and below.

This course will use a "partially-flipped" approach (a "flipped classroom" is one in which the students work on the material *in advance* of seeing it in class, and classtime is then used to more fully explore conceptual difficulties and work on examples). Thus, our lectures will not simply be the presentation of the course material by the instructor – they will be interactive, and you will get much more out of them if you have done the advance reading. I want to stress that participating will be very helpful for your learning – it allows you to ask questions, give feedback, participate in the quiz questions that I will ask, watch demos, etc – I strongly encourage you to be there.

A common student comment about flipped classrooms is that the students have to "teach themselves the material". That's not the point – the point is to have enough *familiarity* with the material coming into the classroom to be able to identify the points you find confusing or illogical, and then together (with other students and the instructor) to resolve those difficulties. Said another way, it's perfectly fine to do the advance reading and still have concerns, questions, and things you don't understand – resolving these issues is exactly the purpose of the lectures! Research has shown that this flipped approach can lead to more effective and deeper learning.

To use an analogy: imagine you were taking a film-history course that was going to study 25 of the greatest films of all time (in somebody's ranking). You would probably NOT expect to use the classtime to actually screen the films, would you? More probably, the instructor would suggest you

see the films in advance, and arrive in the class ready to discuss them, using your observations and the instructor's expertise (and the viewpoints of the rest of the class) to deepen your understanding of the film, its context, its repercussions, etc. We'll do the same thing, but with the 25 greatest basic mechanics ideas of all time!

A key component of this partially flipped approach is that **you read ahead in the textbook**, and this reading/discussion will be part of your assessment, as explained above. It will be done through the Perusall system (details below). In our in-person lecture sessions, we will then spend more time on conceptual issues and on problem-solving.

You will need to access course material through the McGill myCourses system. The site will contain this information package, PDF files of the lecture material (in un-annotated versions), lecture recordings, laboratory information, a link to the ANS system that will be used for assignments, a link to Perusall, and other useful course material.

Please consider the lectures as **interactive** – don't hesitate to interrupt me if there is something you don't get!

In the lectures, we will be using a **personal response system ("clickers")**. Use of the clickers will be monitored (that is, I record the answers), but will **not** be graded. We will use a clicker app called Slido (slido.com), which you can access through an app or on a browser. You will need a Session ID that will be provided in class, and will need to log in to slido using your firstname.lastname@mail.mcgill.ca authentification.

Perusall

The weekly online reading will be done through the Perusall© tool (there's a link in myCourses). Perusall is a system that is designed to encourage your participation with the material by having you read, annotate the material with your observations or questions, **and comment on others' annotations**. We've used Perusall before in this course, and it generally worked well.

Perusall assigns a score from 0 to 3 for each reading. It's got a complicated algorithm that tries to reward reading in multiple sittings (ie, coming back to the material several times rather than just in one session), total time on task (obviously, more is better), annotating, making comments or asking questions, and answering others' questions. It uses a proprietary (AI-based) system to score the quality of your annotations, comments, questions and responses. I will take your assessment score to be the simple average of all your Perusall scores.

I have set up a Perusall assignment for Module 0 **but this will not be a required assignment** – it's simply a chance for you to explore the Perusall system. The first Perusall assignment that will count for assessment will be for Module 1; it will open on September 2 and close on September 7, just prior to our lecture.

Course flow and schedule

We will try to follow the detailed course flow indicated below:

Module	Material	Dates of lectures	Textbook sections	Comments
0	Intro, units, sig figs	Aug. 31, Sept. 2	1.1 – 1.6	
1	1-D motion	Sept. 7, 9, 12	3.1 – 3.5 (3.6)	
2	Vectors, 2-D motion	Sept. 14, 16, 19	2.1 – 2.4, 4.1 – 4.5	
3	Dynamics	Sept. 21, 23, 26	5.1 – 5.7	
4	Applications of dynamics (incl. circular motion)	Sept. 28, 30, Oct. 3	6.1 – 6.4	
5	Energy and work	Oct. 5, 7	7.1 – 7.4	
6	Conservation of Energy	Oct. 13, 17	8.1 – 8.4	
	Midterm exam	Oct 18, evening	On Modules 1-6	
	Midterm debrief	Oct 19		Missing Oct 21?
7	Momentum and collisions	Oct. 24, 26, 28	9.1 – 9.7	
8	Rigid body rotation	Oct. 31, Nov. 2, 4	10.1 – 10.8	
9	Angular momentum	Nov. 7, 9, 11	11.1 – 11.4	
10	Gravitation	Nov. 14, 16, 18	13.1 – 13.5	
11	Oscillations and SHM	Nov. 21, 22, 25	15.1 – 15.6	
12	Waves	Nov. 28, 30, Dec. 2	16.1 – 16.6	
	Wrap-up, review	Dec. 5		

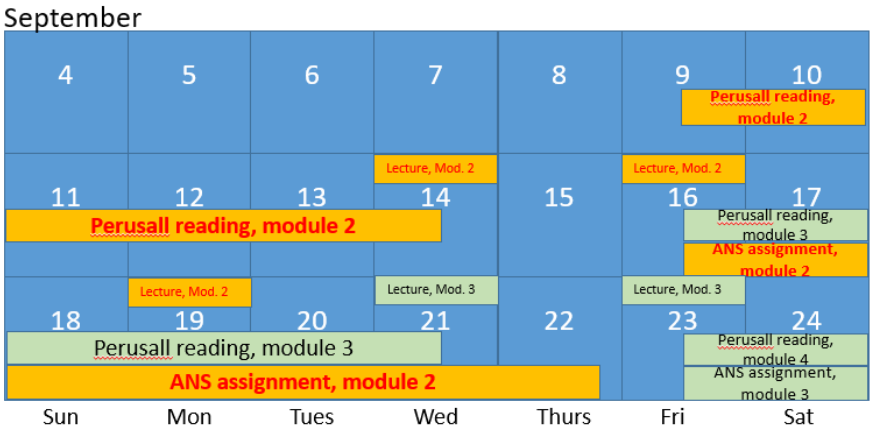
In red (Thursday, Oct 13): day that is not the standard MWF schedule because of Fall Reading Break.

You will notice that, prior to the midterm, most of the modules above have a Wednesday/Friday/Monday schedule. This gives us the following weekly structure for the course for those first several weeks (we may have to change due dates of readings and assignments after the midterm, though):

Typical week in PHYS 131, module N
(schedule may change after Thanksgiving break!)

New modules: start Wednesday, then Friday, conclude Monday
ANS assignments: start on Friday (noon), close Thursday (9 pm)
Perusall readings: start on Friday (noon), close Wednesday (noon)
Peer Collaboration (drop-in tutorials): Monday, Thursday 3-5 pm

Example with Module 2 (2-D motion), in orange below:



So the general scheme is: read Perusall in advance of the module; cover the module in several

lectures/sessions; then do ANS assignments on the concepts in the module.

There will also be drop-in (voluntary) tutorials run through the Peer Collab program run by the Faculty's Office of Science Education (OSE). See details below.

Assignments/ANS

The assignments, done on the web through the **ANS** system (link available through myCourses), will be available for one week each, with the first assignment starting approximately September 7. After the one-week time period for each assignment, results will be posted and there will be no further credit granted.

The ANS system allows us to create individual assignments for each student, generally by randomizing the numbers in the problems. It also allows you to respond multiple times until the correct response is given. You will not be docked points for using the multiple chances (that is, you get full marks if you finally get the question right, even if it takes you many tries to do so – but you should understand the concept of "diminishing returns"!). The heart of doing physics is problem-solving; used correctly, the assignments allow you to hone your problem-solving skills.

The ANS system, like all systems, has some idiosyncrasies, so be careful with it. We've put together a two-page "Hints and Help" document about it which will be posted on myCourses.

If you are having technical difficulties with ANS, send email to ANS@physics.mcgill.ca .

Labs

You may be used to the idea of labs as a means of reinforcing the lecture content of a course. In fact, research shows that labs don't do this very well at all, and our labs don't have that in mind as a primary goal.

Instead, the goal of the lab component in this course is to try to give you experience in the art of experimental physics – the process of setting up an experiment, taking data, thinking about that data (including their limitations), improving on the measurement, and communicating the results. Of course, we'll use some of the basic phenomena that we see in the course, but the labs are much more about the *experimentation* than they are about the phenomena themselves. They are meant to be exploratory, as well as a general introduction to the issues of measurement and uncertainty.

You have all signed up for a 3-hour lab section, and Minerva puts that on your schedule weekly. But in fact, there will only be four in-person labs throughout the term, and **they won't start until the week of September 26** (there will also be one online lab assignment, starting September 12). More detailed information, and a schedule, will be posted on myCourses by early September.

The labs are mandatory in this course and you must pass the lab component (ie, achieve 55% or better) in order to pass the class.

If you have taken this course at McGill before and did not pass, but did pass the lab portion, then contact me. Under certain conditions, I will accept your previous lab mark for this course and exempt you from the lab activities this term.

Tutorials

Tutorials will be offered twice per week for those who would like to have more help. Tutorial attendance (like class attendance!) is **not compulsory**. Tutorials give you the chance to meet with teaching assistants and mentors to discuss particular ideas, concepts, or problems that you may be having trouble with, and of course to work together on problems (including the ANS assignments).

The tutorials will be run through the OSE SciLearn's Peer Collaboration (Peer Collab) program, and held at the RVC Cafeteria. For PHYS 131, a TA and an undergraduate TEAM mentor (students who have recently taken the course) will be present on Mondays and Thursdays from 3-5 PM. Other U0 science courses will have TAs and mentors present too; it's designed to be a one-stop-shop for collaborative work. Space is limited in the RVC Cafeteria, so be patient in the early days of September, though!

Peer Collab sessions will start the week of September 12.

Miscellanea

A **scientific calculator** with trig functions, square roots, and logs is essential for the course and for the examination. Graphing calculators are fine but this feature is **not** necessary (nor, in my opinion, very useful!). Simple calculator models in the $10 range are available at the bookstore.

In the exams, I will allow you a one-page formula sheet **of your own making**. For the midterm, you're allowed one-side of the page; for the final exam, both sides. You can put absolutely anything on the page – but I encourage you to start to develop it as we work through the course, and get used to working with it for ANS assignments and other problems.

A note about your health

You're in the big leagues now: you're studying at a major research university and there will be lots of stressors, including large classes like this one. **Your health – mental, physical, emotional – should be one of your highest priorities!** McGill has a "Wellness Hub" where extensive support and help is available to students, and I urge you to check it out. Also check out the **OSD (Office for Students with Disabilities)** if that is appropriate for you. Links are provided at the end of this document.

If you are having problems in my class, I also urge you to contact me directly.

The (legal) Fine Print

I hope you've all seen the standard McGill legal warning about academic integrity:

> "**McGill University values academic integrity. Therefore all students must understand the meaning and consequences of cheating, plagiarism and other academic offences under the Code of Student Conduct and Disciplinary Procedures (see http://www.mcgill.ca/integrity for more information)**."

Here are two more bits of legalese that I'm supposed to bring to your attention:

> **In accord with McGill University's Charter of Students' Rights, students in this course have the right to submit in English or in French any written work that is to be graded.**

> **Since polling records may be used to compute a portion of course grades, responding as someone other than yourself is considered an academic offense. During class, possession of more than one response device or using the credentials of another student will be interpreted as intent to commit an academic offense. Please refer to McGill's policy on Academic Integrity and Code of Conduct.**

That's it for now! Welcome to PHYS 131 and to McGill, and have a great semester!

Useful Links & Contacts

Instructor:	ragan@physics.mcgill.ca
Head lab TA for lab issues:	lisa.rudolph@mail.mcgill.ca
ANS technical help:	ANS@physics.mcgill.ca
SciLearn/Peer Collab:	www.mcgill.ca/ose/scilearn-peer-collaboration
Physics department reassessment policy:	www.physics.mcgill.ca/grads/reassessment.html
Academic integrity:	www.mcgill.ca/integrity
Wellness hub:	www.mcgill.ca/wellness-hub
Office for sexual violence response & support:	www.mcgill.ca/osvrse
Office for students with disabilities:	www.mcgill.ca/access-achieve

Policies on student rights and responsibilities:
www.mcgill.ca/sutdents/srr/policies-student-rights-and-responsibilities