

PHYS 1303

Introductory Mechanics

Prof. Jodi Cooley
Prof. Stephen Sekula

Course syllabus
SPRING 2021



SMU

DEDMAN COLLEGE
OF HUMANITIES & SCIENCES

PHYS 1303

Introductory
Mechanics

by

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*“The value of a college education is not the learning of many facts but the training of the mind to think, he
[Einstein] said.”*

— Walter Isaacson, “Einstein: His Life and Universe,” 2007



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Preface

We are very pleased to be teaching Introductory Mechanics in Spring 2021. Despite the challenges of the ongoing COVID-19 pandemic, we intend to create an engaging, exciting, cooperative classroom. We foster an active learning environment, in which students take direct ownership of the learning process. You will be immersed in physics learning: outside the classroom in readings, videos, and problem-solving; inside the classroom by learning how to setup and solve problems and engagement in the principles and implications of physics through experience with physical phenomena and inquiry-based learning, both at the individual and the group level.

*Prof. Jodi Cooley
Prof. Stephen Sekula
Dallas, January 2021*

Contents

1	The University and Learning Context	1
1.1	University Curriculum Student Learning Outcomes	1
1.2	Goals of this Course	1
2	Specifics of this Course	3
2.1	Course Information	3
2.2	Course Topics	4
2.2.1	Examples of Special Topics	4
2.3	Assessment Components	5
2.3.1	The Rhythm of the Course	5
2.3.2	Attendance and Participation	6
2.3.3	Quizzes	6
2.3.4	Homework	7
2.3.5	Exams	8
2.4	Grading	10
3	University Policies	11
3.1	Academic Integrity	11
3.2	Policy for Missing Tests and Quizzes	11
3.3	Disability Accommodations	11
3.4	Religiously Observant Students	12
3.5	Excused Absences for University Extracurricular Activities	12
3.6	Pregnant and Parenting Students	12
3.7	COVID-19 Attendance Statement	12
A	Appendix	15
A.1	Homework and Written Materials Policy	15
A.1.1	Format	15
A.1.2	Solutions and Answers	16
A.1.3	Academic Honesty	17
A.1.4	Advice for Writing Good Solutions	18
A.1.5	The DIANA Method	18
B	Professional Etiquette	21
C	Policy on Changes to Grading	23
C.1	Policy: Deadlines on Grade Change Requests	23
D	Teaching Philosophy	25
E	Important Dates	27

1

The University and Learning Context

1.1. University Curriculum Student Learning Outcomes

Pure and Applied Sciences Level 1 [PAS1] Student Learning Outcomes:

1. Students will be able to demonstrate basic facility with the methods and approaches of scientific inquiry and problem solving.
2. Students will be able to explain how the concepts and findings of science or technology in general, or of particular sciences or technologies, shape our world.

Quantitative Reasoning [QR] Student Learning Outcomes:

1. Students will be able to develop quantitative models as related to the course subject matter.
2. Students will be able to assess the strengths and limitations of quantitative models and methods.
3. Students will be able to apply symbolic systems of representation.
4. Students will be able to test hypotheses and make recommendations or predictions based on results.
5. Students will be able to communicate and represent quantitative information or results numerically, symbolically, aurally, visually, verbally, or in writing.

1.2. Goals of this Course

As described in the SMU Undergraduate Course Catalog:

For science and engineering majors. Covers vector kinematics, Newtonian mechanics, gravitation, rotational motion, special relativity, and structure of matter.

The specific learning goals of this course are as follows. Upon successful completion of this course, students will be able to:

1. Describe matter in reference to space and time and its kinds of motion in space, explain the relationship between force and motion in space, describe the laws of nature that are known to explain motion, describe the relationship between energy and motion, as well as the kinds of energy available to matter, and to describe the force due to gravity;
2. Setup and solve quantitative problems in the areas described above, and thus be able to apply their understanding of space, time, motion, force, energy, and gravitation to areas other than physics, including the sub-fields of STEM (Science, Technology, Engineering, and Mathematics) and everyday life;
3. Demonstrate, through performance on homework, quizzes, in-class exercises and discussion, and exams, a clear understanding of the principles and application of the above concepts.

2

Specifics of this Course

2.1. Course Information

When/Where?	The course is held on Zoom on Tuesday and Thursday from 9:30am-10:50am
Instructor	Professor Jodi Cooley Office: Fondren Science 151 Phone: (214)-768-8647 E-mail: cooley@physics.smu.edu Twitter: profcooley
Instructor	Professor Stephen Sekula Office: Fondren Science 39 Phone: (214)-768-7832 E-mail: sekula@physics.smu.edu Facebook: stephensekula Twitter: drsekula
Office Hours	Where: Virtual Only When: <ul style="list-style-type: none">• By appointment through Canvas - see Canvas Calendar for our Course <p><i>Note: additional help sessions can be arranged with a Teaching Assistant</i> Cancellations of office hours, when unavoidable, will be announced by e-mail. If you cannot make regular office hours, you need to schedule a separate time to meet with the instructor or a teaching assistant. It is your responsibility to do this. <i>Please try to be courteous and request a meeting in writing at least a day before your proposed meeting time to allow for scheduling.</i></p>

Prerequisite(s)	MATH 1337 (can be taken concurrently with the course)
Textbook(s)	REQUIRED: 11th Edition of Halliday, Resnick, Walker. "Fundamentals of Physics Volume I with WileyPlus and Orion" <i>See course website for information about obtaining the course learning system.</i>

2.2. Course Topics

In PHYS 1303 (Introductory Mechanics), you will learn the foundational concepts in physics, the study of space, time, energy, and matter. We begin with the description of matter and measurement of its properties, especially relationships in space and time. We will proceed to discuss motion and various familiar kinds of motion, and learn to describe that motion in the language of space and time. We will then explore force and the nature and relationship of force to motion, and specific kinds of forces including gravitation. We will learn to describe changes in states of motion in terms of the concept of energy, and learn about various kinds of energy and how they relate to one another. The semester will culminate in the topic of rotational motion of extended material bodies, a subject that combines all previous concepts. Finally, we may close with some “special topics” that are direct spinoffs of the topics in the course. The nature of these “special topics” will be decided over the course of the semester in consultation with the students in the class. Throughout the course, applications of the study and use of space, time, motion, force, and energy will be discussed.

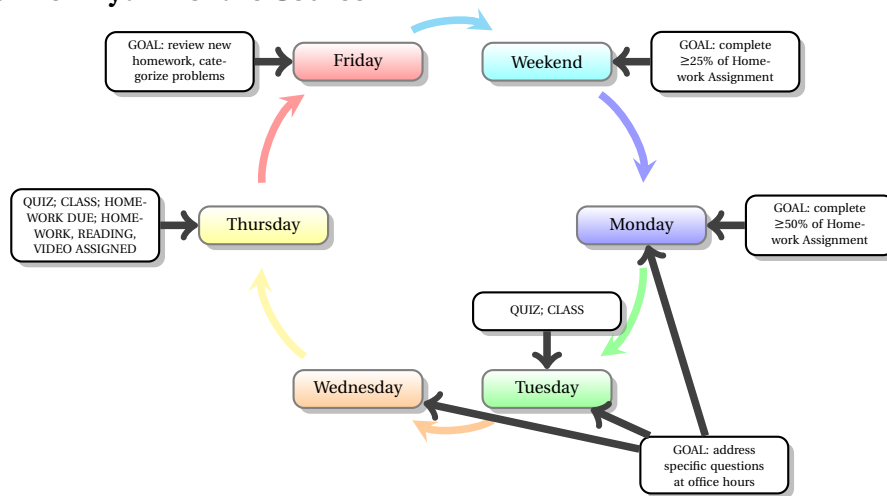
2.2.1. Examples of Special Topics

Be on the lookout throughout the semester for news that connects to our course. Suggest that as a topic for the final lecture (a poll to collect topics goes out about 2 weeks before the end of the course). Here are past special topics that resulted from student suggestions, followed by students up-voting topics that were then selected for the final lecture:

- **Spring 2018: “Deep Learning the Dark Cosmos”**
Machine learning, deep learning, and applications to the hunt for the constituents of “dark matter,” the non-luminous matter that has shaped the cosmos. Available on YouTube: https://www.youtube.com/watch?v=T_F675I7pRc
- **Fall 2018: “Light and the Dark Cosmos”**
The history of the student of the nature of light, the modern understanding of light, and what light and matter together tell us about the real players that shape our universe: dark energy and dark matter. Available on YouTube: <https://www.youtube.com/watch?v=Bz6IfSy027k>
- **Spring 2019: “Lives of Stars, Death of a Universe”**
The physics of stars, their life cycles, and how they die. The deaths of stars is discussed as a tool for measuring cosmic distances. The measurement of cosmic distance scales implies a particular fate for the entire Cosmos. Available on YouTube: <https://www.youtube.com/watch?v=FtEv4UBCw8c>

2.3. Assessment Components

2.3.1. The Rhythm of the Course



A typical week (excluding those with exams and weeks with official university holidays) should look as follows:

1. Monday: you are finishing the reading and video lecture viewing assigned in the prior class period. You have taken notes on your reading and video lecture watching, with emphasis on key concepts, formulas and their meaning, and the implications of new ideas, as well as any means by which the key ideas have been established (e.g. experiments). A quiz will be assigned online to assess your absorption of this material. Once you begin this quiz, you have 5 minutes to complete it (see Section 2.3.3). You will also continue working on homework assigned the previous Thursday. By now, you should have tried to complete all of the problems and succeeded in completing something like 40-50% of them. You should have a list of concerns and questions to bring to office hours.
2. Tuesday: you come to class to engage in exercises, demonstrations of physical phenomena, and demonstrations of problem solving, based on the reading and lecture video. Strong attendance correlates with good performance in the course (see Fig. 2.1). You will work alone and with peers to engage in classroom activities. You will have access to the instructor and teaching assistants to answer questions. You will be assigned further reading and lecture video material for next class.
3. Wednesday: again, you should be finishing assigned reading and lecture viewing assigned on Tuesday, and taking the associated online quiz. You are also finishing up the homework assigned the prior Thursday. By this point, you should have completed at least 75% of the homework and be ready to finish the remainder to hand in the next day. Numerical answers go into the WileyPlus online assessment system; your written solutions (see Sections 2.3.4 and Appendix A.1) should be nearly complete and ready for handing in on Thursday morning.
4. Thursday: you come to class, hand in your written solutions (there is usually a collection station), and engage in further exercises (as on Tuesday) focused on going more into the material from the reading and lecture video. New homework is assigned for the following Thursday.

5. Friday: you review the homework problems and note which ones you think will be straight-forward for you, based on reading, lecture videos, and class exercises; you also note the ones that might give you more trouble. Try working on the ones that look more approachable, with the goal of completing up to 25% of the homework on Friday.
6. Weekend: use the weekend to review notes and class material and keep working on homework. Your goal is to get to the end of Monday with the sense that you've completed about half or more of the homework.
7. Repeat...

During exam weeks, no homework is due in order to facilitate review and study (homework will be due the week following the exam and will typically be longer as a result, so don't procrastinate too much).

This is a 3-credit hour course, which means we have 3 contact hours during the week (class periods) and you are expected to work 6-9 hours outside of class to further your study for the course (this includes reading, lecture video, and homework, as well as any other studying you need to do). This is typical of a serious and rigorous university physics course at the introductory level. Data gathered from previous semesters of this course is compatible with these expectations, and you should expect no different.

2.3.2. Attendance and Participation

Your attendance in the class will be checked through the assignment of homework, your participation in quizzes, and through participation in classroom discussions and activities. Poor attendance will be reflected in your performance in the three areas. This course respects the University policies on excused absences; please see the relevant section below. Attendance and course performance are strongly linked (see Fig. 2.1). Given the clear importance of attendance and participation in classroom activities to your learning, it is assessed as part of your grade.

If you have an excused absence, either due to an event covered by University policies or by enrollment (e.g. you were not enrolled in the first week of class), the attendance/participation grade for that day will be dropped *automatically* and will not count toward your final participation grade. Your two lowest participation/attendance grades are automatically dropped at the end of the course. Excused absences NEVER count against you.

A student who is absent from class without valid reason for two consecutive weeks will be administratively dropped from the class by the instructor.

2.3.3. Quizzes

There will be reading quizzes assigned in the 24 hours before the class period for which material is used. For instance, if reading and a lecture video are assigned on a Tuesday, then from Wednesday through Thursday (until the start of class) you can take the quiz on that material.

Quizzes are timed, and *you must complete the quiz all at once and in the allotted time*. The quiz is to be taken alone, with no collaboration with anyone else. You can use notes or other resources from your studying of the reading and the video, but no one is to help you take the quiz. It is in your best interest to treat reading and video assignments as you would any standard lecture: take notes, review them, ask questions of peers or others before committing to take the quiz. Once you commit to taking the quiz, time is limited.

These quizzes will incrementally cover the reading and lecture video material assigned since the previous class, but may also draw on experience with earlier topics. Your two lowest quiz grades will auto-

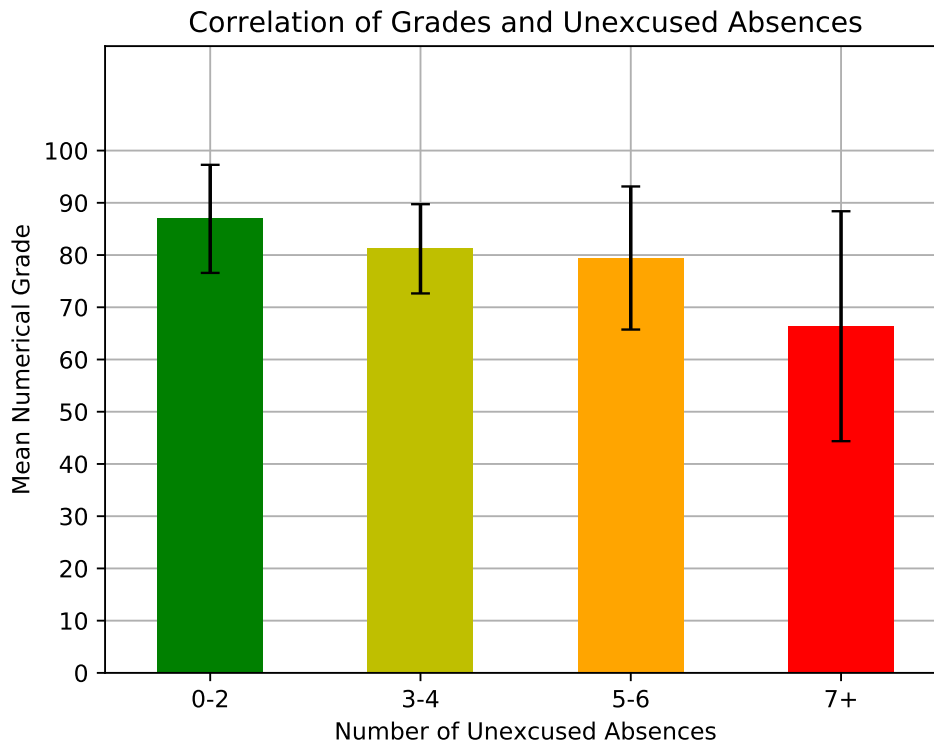


Figure 2.1: Attendance and your ability to learn, and demonstrate learning of physics, are strongly correlated. The above graph shows the mean student grade vs. the number of unexcused absences, for past iterations of this course taught by this instructor. Note how even a modest decline in attendance and participation correlates with decline in overall performance. It's easy to take a “won't happen to me” attitude, but the numbers don't lie. 0-2 absences means no or 1 week's worth of classroom activities missed; 3-4 absences equates to two weeks' worth of activities; 5-6 corresponds to three weeks' worth of absences; 7 or more means a student has missed at least one-third of the entire course's worth of classroom activities. The error bars indicate the standard deviation of the distribution in each bin.

atically be dropped. The assigned reading and lecture videos will be your primary means of studying for the quiz.

The results of your quizzes will be used to influence learning during the next class period. Quizzes are not a chance for you to impress the instructor, but rather the opposite: the instructor will use them to identify “learning hot spots” that need attention, and class time will be used, in part, to address those “hot spots.”

2.3.4. Homework

Homework problems will be assigned in class.

- Homework will typically be assigned on a Thursday and due the following Thursday
 - The lone exception to the above is the first day of class (a Tuesday), when homework will be

assigned and due two days later.

Reduced credit (a maximum of 85% of the value of the assignment) will be given for late assignments, and no credit for missed assignments. An assignment is considered “late” if it is submitted even 1 second beyond the due date and time.¹ A formal written materials policy appears in the appendix of this syllabus (Appendix A.1) .

GRADING RUBRIC

PROBLEM 1 (TOTAL POINTS: 10)



WWW.PHDCOMICS.COM

Figure 2.2: You'll be tempted to wait to the last minute to start your homework. You'll even be tempted to wait to the last minute to write up what you've done. Then it comes to us, unstapled and half-crumpled with no name and the spelling and grammar of a TwitterBot. You have been warned. Images are copyright Jorge Cham, and available at <http://www.phdcomics.com/comics/archive.php?comid=1319>

2.3.5. Exams

There will be a series of in-class exams throughout the semester. These will come in two varieties: mini-exams and exams. Mini-exams are smaller spot-checks of accumulated learning (assessing a period of

¹The National Science Foundation and U.S. Department of Energy's Office of Science do not accept funding proposal submissions that are beyond the deadline, even from brilliant scientists. I expect you to adopt the mentality that the deadline means something, because deadlines mean something. Respecting a deadline is a basic sign of respect for a colleague or co-worker.

weeks); exams are assessments of longer periods of learning (about 1 month or a little more). **Please see the website of the course for the specific dates.** Those dates are fixed from the very beginning of the class, and the final exam period is fixed by the University.

Exams generally assess your learning on the section of material since the previous examination (for exam 1, the starting point is the beginning of the class), but can certainly include prior material as this class builds upon what is established, as does all scientific learning. The final exam is comprehensive, assessing you on new material since the previous in-class exam and all prior course material. Exams are to be taken alone, with no consultation by any means with any other individual. You are encouraged to ask the instructor or teaching assistants questions during the exam, but we will not answer questions such as “Is this correct?” or “Can you tell me what to do next?” If you have a question of clarification of a word, phrase, or similar request, that is fine, but concepts and problem solving are up to you. You need to demonstrate to us the level of confidence you have in your own learning, and your ability to apply the material from the course. You may only use resources provided to you during the exam to help with the exam; you may be asked to bring your own calculator and writing implement, but that is usually all you are allowed to have during an exam.

Cheating during examinations: We cannot emphasize enough that *cheating during an exam (or any other academic activity, really) will result in expulsion from the exam room and an immediate “F” (score: 0%) on the exam, if not in the entire course* (see Section 3.1 and Appendix A.1.3). In addition, your academic advisor will be contacted and an academic violation will be filed against you.

To help you understand what it means to cheat, here are a few examples of exam cheating. This list is by no means comprehensive - faculty have seen many different means of attempting this during classes - and so if you devise some other means to commit an academic violation we are likely to detect it and the punishment is the same. Here are some examples:

- Using chat or instant messaging applications to share information, or using voice or video software to do the same.
- Leaving your work (e.g. solutions) out where others can see them - you are facilitating cheating when you do this, and are yourself guilty of cheating.
- Looking at another person's work or calculator during the exam. Keep your eyes down and on your own work at all times.
- Sharing calculations in any form with anyone in the class.
- Using any wireless or wired communication device of any kind to interact with anyone at all during the exam.
- Using any other means of communication during class (e.g. passing messages in class or using bathroom breaks to do so; any digital means of trading information).
- Bringing solutions or other reference material to use during the exam. (any non-approved material used during an exam is grounds for failing the exam)
- Sending another person to class to take the exam for you, or using another person's identity to take the exam.



Figure 2.3: Before you ask your instructor, “Will this be on the test?”, think very, very, very carefully. Images are copyright Jorge Cham, and is available at <http://www.phdcomics.com/comics/archive.php?comicid=1875>.

2.4. Grading

Your course grade is composed of the following pieces: attendance and participation (5%), quizzes to assess out-of-class learning of new material (5%), homework to assess basic mastery of material (10%), in-class exams (worth a total of 45%) to assess more comprehensive individual mastery of material, and a final exam (30%) to assess total synthesis of material.

The grading scale used in this course is standard and that recommended for courses at SMU. For the ranges, a “[“ or “]” indicates the adjacent number is included in the range, while a “(“ or “)” indicates the adjacent number is excluded from the range.

Name	Range	Interpretation	Comments
A	[94,100]	Excellent Scholarship	For all of these, you have done well in the course and can proceed to the next stage. For students who earn a grade in the C range, speak with me at the end of the course to develop a plan to address any deficiencies before proceeding to the next course.
A-	[90,94)	Excellent Scholarship	
B+	[87, 90)	Good Scholarship	
B	[84,87)	Good Scholarship	
B-	[80,84)	Good Scholarship	
C+	[77, 80)	Fair Scholarship	
C	[74,77)	Fair Scholarship	
C-	[70,74)	Fair Scholarship	These may prevent you from counting this course toward your major/minor. Consult your academic adviser.
D+	[67, 70)	Poor Scholarship	
D	[64,67)	Poor Scholarship	
D-	[61,64)	Poor Scholarship	You will have to re-take the course for certain. See guidelines for first-year students and for other students in University Course Catalog.
F	[0,61)	Fail	

3

University Policies

3.1. Academic Integrity

According to university policy, cheating or plagiarism of any kind is strictly prohibited and subject to disciplinary action. Please take the time to read the SMU Honor Code ¹. All students will be expected to adhere to it. Any student found conducting a violation of the honor code - academic sabotage, cheating, fabrication, facilitating academic dishonesty, or plagiarizing - will *at the very least* earn a zero for that work. In addition, a complaint will be filed through the Vice President for Student Affairs Office. If you are uncertain of the definition of academic misconduct (especially plagiarism) as it regards independent works of mathematical and physical computation, documentation, and demonstration, it is your responsibility to speak with the instructor. Ignorance of the definition of plagiarism, or any other academic violations, is not considered a viable excuse to avoid penalties for these acts.

3.2. Policy for Missing Tests and Quizzes

Students who miss a test because of illness or other compelling circumstances as determined by the instructor may make arrangements to make up the test. No student has the right to request a make-up test for other reasons, aside for absences for scheduled, officially sanctioned University extracurricular events. Requests for make-up tests will be dealt with on a case-by-case basis. Students who miss a quiz because of illness or other compelling circumstances will have that quiz excused at the discretion of the instructor.

3.3. Disability Accommodations

Students needing academic accommodations for a disability must first register with Disability Accommodations Success Strategies (DASS). Students can call 214-768-1470 or visit <http://www.smu.edu/Provost/SASP/DASS> to begin the process. Once approved and registered, students will submit a DASS Accommodation Letter to faculty through the electronic portal DASS Link and then communicate directly with each instructor to make appropriate arrangements. Please note that accommodations are not retroactive and require advance notice to implement.

¹<https://www.smu.edu/StudentAffairs/officeofthedeanoofstudents/StudentHandbook>

3.4. Religiously Observant Students

Religiously observant students wishing to be absent on holidays that require missing class should notify their professors in writing at the beginning of the semester, and should discuss with them, in advance, acceptable ways of making up any work missed because of the absence. (<https://www.smu.edu/StudentAffairs/ChaplainandReligiousLife/ReligiousHolidays>)

3.5. Excused Absences for University Extracurricular Activities

Students participating in an officially sanctioned, scheduled University extracurricular activity should be given the opportunity to make up class assignments or other graded assignments missed as a result of their participation. It is the responsibility of the student to make arrangements with the instructor prior to any missed scheduled examination or other missed assignment for making up the work. (See 2020-2021 SMU Undergraduate Catalog ² under Enrollment and Academic Records/Excused Absences.)

3.6. Pregnant and Parenting Students

Under Title IX students who are pregnant or parenting may request academic adjustments by contacting Elsie Johnson (elsiej@smu.edu) in the Office of the Dean of Students, or by calling 214-768-4564. Students seeking assistance must schedule an appointment with their professors as early as possible, present a letter from the Office of the Dean of Students, and make appropriate arrangements. Please note that academic adjustments are not retroactive and, when feasible, require advance notice to implement.

3.7. COVID-19 Attendance Statement

Students who are experiencing COVID-19 symptoms or who have been notified through contact tracing of potential exposure and need to self-quarantine or isolate must follow the protocols laid out in SMUs Contact Tracing Protocol ³). To ensure academic continuity, students in these situations will not be penalized and will be provided appropriate modifications to assignments, deadlines, and testing. Please also note that SMUFlex classes might, in rare circumstances, go remote for two-week periods to accommodate COVID-related issues. To ensure these necessary accommodations, affected students must:

- Provide as much advance notification as possible to the instructor about a change in circumstances. Students must notify their instructor about a potential absence as well as plans for a return to class. For cases in which students test positive for COVID-19, they should fill out a CCC form at this link ⁴ (Links to an external site.)
- Communicate promptly with the instructor to establish, as necessary, alternative assignments and/or changes to deadlines and exams. Students are then responsible for meeting the expectations laid out in these alternative arrangements.
- Continue participation in class via Zoom, as health circumstances permit. Attend class regularly, when not in a situation outlined above, in accordance with safety measures laid out by SMU CAN in the Pledge to Protect ⁵ (Links to an external site.) (including wearing masks, maintaining social distancing, and cleaning personal space after class). In-person participation in SMUFlex classes is

²<https://catalog.smu.edu/content.php?catoid=51navoid=4645hl=%22excused+absences%22returnto=search>

³<https://www.smu.edu/Coronavirus/Contact-Tracing>

⁴<https://cm.maxient.com/reportingform.php?SouthernMethodistUnivlayout;d=1>

⁵<https://cm.maxient.com/reportingform.php?SouthernMethodistUnivlayout;d=1>

required on students assigned red/blue rotation days except in cases when students are experiencing illness, are in self-quarantine or in isolation.

- Students facing multiple or extended COVID-19-related absences or illness can work with the Office of the Dean of Students to consider options such as fully remote learning or medical withdrawal.

This policy, aligned with the SMU Honor Code⁶ and the SMU Pledge to Protect⁷, relies on mutual trust and respect between students and faculty to ensure safety, academic integrity, and instructional continuity.

⁶<https://www.smu.edu/StudentAffairs/OfficeoftheDeanofStudents/StudentConduct/HonorCouncil>

⁷<https://smu.az1.qualtrics.com/jfe/form/SV2ib3rgSmWNktGvj>

A

Appendix

A.1. Homework and Written Materials Policy

“Written Material” refers to any document, electronic or hand-written, you submit to the instructor for assessment. This can include quizzes, homework, research papers, exams, and any other similar material, submitted in digital or analog formats.

Most of your homework will be handed in electronically through the WileyPLUS system. However, this course will test your ability to not only get the correct answer to a problem but also to demonstrate that you can correctly solve a problem and write clear, accurate solutions with all work shown. The following policy provides the strict guidelines covering any written material which you submit to the instructor for grading (e.g. written solutions to homework, or any solutions written up for an in-class engaged exercise).

As in the humanities, communication in science relies on clear, well-defined standards that enable the free flow of information between parties. My standards are designed with that free but structured flow of information in mind. If you have concerns about any of the below requirements, please discuss them with me during open office hours or by appointment.

A.1.1. Format

All written material submitted for grading must contain the following or will receive an automatic ZERO GRADE.

- **Your full name**
- **The name of the current assignment** (e.g. Homework 1, Reading Quiz 5, etc.)
- **The date on which you handed in the material**
- **The title of each problem requested for submission** (e.g. Problem 21.7, Problem SS-5, etc.) above the work associated with that problem.

All written material must have the following qualities, or will receive an automatic ZERO GRADE:

- **Writing must be legible.** If the instructor/grader cannot read your work to determine your method or approach, no partial credit can be assigned. A completely illegible assignment receives an automatic zero (small print, messy handwriting, etc.). You are always free to type your assignment using Microsoft Word (Office365), Google Docs, LibreOffice Writer, or a similar program.
- **Writing must be coherent.** Any written answer must be formatted with a clear sentence structure: subject, verb, and object. Writing must adhere to the guidelines of good English prose and Scientific Writing¹: short, declarative sentences clearly explaining answers, ideas, etc. Flowery prose will get you nowhere. Mathematical solutions must also be coherent. The equations should flow like sentences, one building into the next with a clear path from your original equations to your final solutions. Show as many steps in your work as you can – the smaller the steps, the more likely you are to spot mistakes quickly. If you provide insufficient steps to demonstrate how and why you were able to solve the problem, we cannot give you full credit. Right answers without clear, mathematical justification or written explanations will almost always receive low/no credit.

In addition, if you are required to digitize your written work and submit it electronically (e.g. upload to Canvas or a similar system), the following are required (if not met, the assignment receives an automatic ZERO GRADE):

- **Scans/photos of work must be good quality.** Any digital image of written work needs to be bright enough to be read clearly on a screen. If a photo or scan of your assignment is hard for you to read on a screen (e.g. on your Laptop, iPad, etc.) then it will be even harder for us to read. Any document that is too faint, too dark, or has too poor contrast to be easily read, automatically fails this requirement.
- **Scans/photos of work must be in the correct orientation.** Often during photographing, devices like phones and iPads will automatically rotate images. If you upload them, they appear in an orientation other than upright and easily readable. All images/scans must be in the upright orientation, or they fail this requirement.²

A.1.2. Solutions and Answers

The formatting of good solutions is described further below, and examples are available on the web (<https://www.physics.smu.edu/sekula/phys1303/GoodHomeworkExample.png>). In addition to legible and coherent solutions, the answers to solutions must have the following qualities in order to receive full credit:

- **Answers must be boxed:** the final numerical or written answer to a problem must have a clear box drawn around it. This indicates your commitment to your solution and makes it clear to the grader what you intended as your final result. Failure to box your answer, even if it is correct, will result in a loss of credit.

¹c.f. “The Scientist’s Guide to Writing: How to Write More Easily and Effectively throughout Your Scientific Career” by Stephen B. Heard or “A Scientific Approach to Writing for Engineers and Scientists (IEEE PCS Professional Engineering Communication Series)” by Robert E. Berger.

²While we do not make specific software recommendations to address the orientation issue, students have had excellent success with the mobile app “CamScanner”. This take camera images and generates a PDF file with the correct orientation for Canvas.

- **Numerical answers must have the correct units:** The importance of units cannot over over-emphasized. Satellites have crashed on Mars because somebody messed up units! Failure to put the correct units, or any units at all (where units apply), next to your numerical answer will result in a loss of credit.
- **Numerical answers must have the correct significant figures:** Numbers have limitations; no number derived from measurement can be known perfectly. Applying the rules of significant figures teaches you this limitation. Therefore, please review the rules of significant figures (<https://www.physics.smu.edu/sekula/phys1303/notes.html#Sigfigs>) and apply those rules to your answers. Failure to apply these rules correctly will result in a loss of credit.

A.1.3. Academic Honesty

You are encouraged to work together to solve problems. However, you must also follow the basic guidelines of academic ethics³. Please see the bullets below for some basic guidance on this, as well as for some positive ways you can adhere to these guidelines.

- **Written solutions to problems must be your own work, and not copied from anybody else.** While you are encouraged to collaborate to solve problems and learn from one another, copying each others' work WILL NOT BE TOLERATED. Any evidence of such behavior will result in proceedings in accord with the University Honor Code.
- **Numerical answers must be arrived at by your own work.** If evidence is obtained that suggests students in the class are sharing answers, steps will be taken in accord with the University Honor Code. Sharing of answers and failure to pursue your own solution, even based off collaboration on a problem, WILL NOT BE TOLERATED.

If you work together, please follow these simple guidelines to acknowledge your positive collaboration with your peers:

- **Write the names of your collaborators at the top of your submitted work.** Acknowledging collaboration is like citing sources in a research paper; it gives credit to those who help you and whom you help, while asserting that the work submitted it still a product of your effort.
- If you have arrived at a solution as a group, separate from one another and each work the problem independently to see that each member of the group can follow the approach and agrees that this is the correct solution. This will also result in independent write-ups of the solution to a given problem.

³Here, we make an important side comment. Heed it well. We are very much aware of the existence of student and instructor solution manuals (published by the book publisher) and online, internet-based solution sites and forums (where students trade solutions to problems from established physics textbooks). I make the following statements of caution regarding these resources. First, copying solutions from any such sources is a violation of the Academic Honor Code of this University. If caught, you are subject to the same proceedings as apply to plagiarism. Second, our experiences in using these resources to check our own solutions is that a fair amount of the time (maybe as high as 10%), the solutions are dead wrong. If you do not learn physics, you will fall prey to the same trap that claims all people who forego learning and critical thinking: the scam. Sites often charge money for access, and solution manuals cost money, so *caveat emptor... buyer beware*. If you assume these solutions are all correct, you have already made a serious error in judgment. Always... ALWAYS... check the claims of others using your own brain. Third, copying solutions from third-parties means you have likely failed to learn this material, and this will be reflected in your exam scores... which form the MAJORITY of the points earned in this course. The summary: cheating has few upsides and a thousand downsides. Don't cheat. It's better to come to us and admit you are struggling with the material (after all, you've already paid for our help) than it is to suffer in silence and pay the price in your academic career.

A.1.4. Advice for Writing Good Solutions

Writing solutions is like writing an essay - you have to convince the reader that you have understood the question, applied the correct assumptions, and then demonstrate your solution with sufficient detail to defend the answer. Here, we outline some recommendations for writing high-quality solutions. Applying these guidelines will help you to focus your problem solving and communicate your understanding effectively.

1. State and Justify Your Assumptions

- clearly state your assumptions and justify why you have chosen them. This will help your audience determine whether you have understood the question(s) being asked.
- *Critical Question: ask yourself, after restating the problem statement and listing your assumptions and justifications, "Does my restatement of the problem, my assumptions about facts in the problem or needed to solve the problem, align with information given in this problem statement?"*

2. Show Sufficient Work To Convince Your Audience You Understand the Process

- show enough intermediate steps that your audience is convinced you not only understand the question, but that you understand how to answer the question. This includes showing how you apply your assumptions, highlighting any mathematical or physical tricks needed to simplify steps in the solution, and finally clearly showing the answer. In science, *the process* is the most important means by which you demonstrate the correctness of the answer. Showing your work clearly is the most important way to show that you understood the material.
- *Critical Question: ask yourself, after writing up your work, the following question: "Does my solution represent the kind of high-quality work that would be required to serve as a standard for future students, or as a means to teach a peer how to solve the problem without having to ask me questions?"*

3. Comment on the Answer

- Always comment on the answer when asked. If you are not asked to comment on the answer, but you have observed something interesting about the solution, please make a comment. This helps demonstrate that you not only understand the question but deeply understand the answer.
- *Critical Question: at the end of your solution write-up, ask yourself this question: "Could a peer, given this write-up, understand the meaning and implications of the question and the answer to the question?"*

A.1.5. The DIANA Method

The DIANA Method that is employed in the PHYS 1105 and PHYS 1106 Cooperative Problem Solving activities is an excellent basis for preparing a high-quality solution to any problem. We here reproduce the guidance on this method. "DIANA" stands for Description/Diagram, Idea(s), Analysis, Numbers, and Answer.

DESCRIPTION/ DIAGRAM: define unique symbols for unknowns sought and data given, label a diagram with your symbols, include a directed coordinate system, a few words to clarify perhaps.

IDEA(S): state the fundamental idea(s) or principle(s) of physics you will use from the symbolic equations on the formula sheet. You should write it out explicitly for the current problem using your symbols (don't just write numbers immediately).

ANALYSIS: symbolically derive the unknown you want using algebra and calculus

NUMBERS: substitute data for the knowns and perform calculation of the unknown (data = 0 can be substituted early in the ANALYSIS to simplify).

ANSWER: check number makes sense, round to appropriate precision, put units

B

Professional Etiquette

The following rules apply to our classroom and beyond:

- You can use electronic devices during class if they are for supporting your learning (looking up information, participating in polls, performing calculations, etc.). If electronic devices are used instead to distract yourself or others (e.g. by engaging primarily in social media, shopping, etc.) then the teaching assistants are empowered to inform me; your participation for that class will be nullified and count as an unexcused absence. This is to help you learn that you must rule these devices; they must not be allowed to rule you.
- The time before class begins and after class ends is reserved for management of the class. For example, preparation for a physics class (during the time between class periods) requires the setup or disassembly of technology and equipment. Instructors are not to be bothered during this time; if you need to have a discussion, make an appointment (request in writing). The instructor reserves the right to change this policy on a period-by-period basis if class setup or clean up is concluded promptly.
- If you intend to speak with the instructor as a “drop-in appointment,” the only appropriate time to do this is during open office hours. An open office door is not an invitation for you to walk in and interrupt the ongoing research work of the instructor. If you would like to speak with the instructor outside of open office hours or an appointment, and intend to do so by dropping by their office, you should (a) knock on the door or door jamb, (b) wait for the instructor to acknowledge you, and (c) begin by asking, “Is this a good time to talk?” If the answer is “no,” ask for an appointment or send a written request. An open office door is not the same as an open invitation to drop in. Do not linger awkwardly outside an office door; that can be distracting. If a meeting is already in progress in the instructor’s office, do not disturb it.
- Being on-time is a key professional courtesy. This applies to showing up for class (arriving before class starts, leaving only after the official end of class time). This also applies to appointments with instructors. Do not arrive earlier than 1-2 minutes before an appointment begins. If you are 10 minutes (or more) late for an appointment, the appointment is automatically cancelled and must be rescheduled in writing.

- Do not use class time to engage with the instructor in conversation about homework, exams, or grades. Classroom time is for beginning to learn how to handle the basics of a new subject. Do not distract yourself or the instructors with other activities. For instance, it is inappropriate to use class time to ask the instructor questions like,
 - “Why did I lose points on X?”
 - “Can you explain the grading on problem Y?”
 - “Can we discuss my last test right now?”

These topics are correctly discussed during an appointment. All such requests must be made in writing if they fall outside the designated office hours.

- We enjoy a friendly, engaging, and open classroom. Questions and discussion are welcome. However, in order to serve the larger goal of making sure all participating students have a chance to engage in the activities of the day, discussion and questions may be curtailed. For instance, students who find themselves asking a lot of questions or raising a lot of discussion items should ask themselves the following: “How important is this question or point and is it of generally broad interest to most of the students in the room?” If you are not sure, write the question down and make an appointment to discuss it with the instructor. A class is a balancing act between open inquiry and structured learning. Please respect that process.

C

Policy on Changes to Grading

You are free to challenge the grade you have received on a problem or on an assignment. ***These challenges must be presented in writing to the course instructor*** so that they can be discussed during an office hour. However, ***any additional student mistakes identified during the review of the grading will result in additional lost points consistent with those mistakes.*** Just as in the review of any professional work, you therefore stand to potentially gain or lose during the process of a formal review.

C.1. Policy: Deadlines on Grade Change Requests

- The deadline to submit a challenge to the grading on an assignment is within 5 business days after the grade is posted.
- For the last assignment(s) of the semester (those due in the final week of the course), the deadline is 5 business days after the grade is posted or by the end of business on the reading day before final exams begins, whichever comes first.

By University policy, final course grades are due 72 hours after the end of the final exam. If you wish to challenge your final grade, you must do so in accordance with University policies¹.

¹SMU Undergraduate Catalog, "Enrollment and Academic Records," "Grade Appeals" <https://catalog.smu.edu/content.php?catoid=33&navoid=2417>

D

Teaching Philosophy

Learning happens most efficiently when students grapple with a subject, especially an unfamiliar one. Learning is achieved primarily through intellectual struggle. The instructor's job is to present ideas and provide structure for that learning to occur; for individually addressing student-specific issues regarding learning methodologies and strategies; and assessing the student learning from a perspective of what is expected in the field of practice. Ultimately, the student is the person most responsible for the learning process (after all, it's their brain).

In accordance with the above philosophy, the following statements are true about the components of this course:

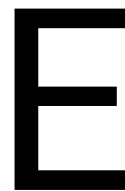
- **Attendance and Participation:** This is the bare minimum expected of all students (in service of your learning). You are expected to attend class periods and participate in learning activities. Doing well on this means you are executing the bare minimum.
- **Quizzes:** These are meant to check your progress on the next-to-minimum activity expected of all students (in service of your learning): to read assigned text and watch assigned lecture videos, take notes in a format appropriate to your learning process, and to use those notes to answer questions about the most basic ideas of the course. Quizzes cannot and do not assess your ability to solve problems using ideas; rather, they assess your basic understanding of the ideas themselves and see if you have grasped a concept forward and backward. Doing well on the quizzes only means that you are keeping up with assigned reading and lectures and curating good notes to which you can refer, as well as beginning to understand the basic concepts of the course.
- **Homework:** These are meant to give you your first foray, as individuals or in small working groups, into problem solving by synthesizing the physics concepts with the language of mathematics. Doing well on the homework means you are beginning to master the skills needed to combine physics and math to solve problems in the natural world. Your ability to deliver these by the given deadline is practice in meeting the deadlines that will be present in your future career. Repeatedly failing to meet deadlines on the homework is a red flag regarding your learning structure and plan.
- **Exams:** These are meant to assess your individual level of mastery of the subjects in the course, with the understanding that the time pressure of an exam adds a new dimension to the learning

process that is not present in the homework. Exams, and your performance on the exams, tells me about your synthesis of material and your ability to execute on the use the physics ideas in the course in combination with mathematics.

The following metaphor will suffice to put in context the pieces of the course. Throughout this course, you are building an intellectual house. Attendance and participation means that you show up to work every day, but it doesn't tell me that you're building anything. Doing well on the quizzes is equivalent to putting down the foundation of the house ("foundational learning"); it points to the strength of the base but doesn't tell me about the quality of the fully constructed house. Doing well on the homework ("structural learning") is equivalent to installing the electrical wiring and the plumbing and putting up the wooden framing; it's absolutely necessary for what happens next, but by itself is not fully telling of the final intellectual product. The exams are the rooms in the house ("total learning"), each building upon the last. The final exam is an evaluation of the whole house.

Even if you do well on exams, a weak foundation weakens the whole house. If you do well on quizzes and attendance, your foundation is in good shape but poor performance on exams means that what is built upon the foundation is unreliable. Doing well on the homework means the backbones of the house are in good shape, but if poor performance still happens on exams then your technique for translating foundational and structural learning into demonstration of total learning is ineffective, and needs work.

Falling behind on any component is a reason to speak with an instructor, and sooner is better than later.



Important Dates

Below we have selected some of the more relevant dates for this term. They come from the official University Calendar¹, but are by no means a reliable replacement for the actual university calendar, which may be amended in some way since this syllabus was written. Always refer to the real University Academic Calendar.

- **January 25, Monday: First day of classes.**
- January 29, Friday: Last day to enroll, add a course, or drop a course without tuition billing while remaining enrolled for the term. Last day to file for graduation in May.
- February 5, Friday: Last day to drop a course without academic record (tuition charges apply). Last day to withdraw from the university without academic record (withdrawal refund schedule applies). See Bursar's website for more information.
- February 9, Tuesday: Last day to declare pass/fail or no credit grading options. Also, last day to request an excused absence for the observance of a religious holiday.
- February 24, Wednesday: Last day for continuing undergraduate students to change their majors before April enrollment.
- March 1, Monday: Early intervention grades due for first-year undergraduate students.
- March 23, Tuesday: Midterm grades due for undergraduate students.
- March 31, Wednesday: 60 percent point of the term that federal financial aid has been earned if a student officially withdraws from SMU; prior to this date a partial calculated return to federal programs will be required.
- **April 2, Friday: Good Friday. University offices closed.**
- April 5-23, Monday –Friday: Enrollment for summer 2021 and fall 2021 continuing students for all undergraduates and graduates in Dedman College, Lyle, Meadows and Simmons.

¹<https://www.smu.edu/EnrollmentServices/Registrar/AcademicCalendarsCourseCatalogs/AcademicCalendars/Calendar18-19>

- April 7, Wednesday: Last day to drop a course (grade of W).
- April 12, Monday: Honors Convocation.
- April 13, Tuesday: Last Day for May graduation candidates to change grades of Incomplete, and to obtain a final grade for a grade of X or a missing grade from a previous term.
- April 21, Wednesday: Students should file for August or December graduation. Last day to file for August graduation is June 4. Last day to file for December graduation is the last day to enroll for fall 2021.
- April 23, Friday: Last day to withdraw from the University.
- April 28-May 3, Wednesday –Monday: No final examinations or unscheduled tests and papers.
- April 29, Thursday: Last day for oral/written examinations for graduate students who are May degree candidates.
- **May 3, Monday: Last day of classes.**
- **May 4-5, Tuesday –Wednesday: Reading Day.**
- **May 6–12, Thursday–Wednesday: Examinations (No examinations scheduled for Sunday).**