

COURSE INFORMATION

PHYSICS 1302.300, Introductory Physics for Science and Engineering II, 4 credits

This class satisfies the Physical Sciences Core and Writing Intensive requirements.

Instructor: Marvin L. Marshak, College of Science and Engineering and Morse-Alumni Professor

Office: 330 Physics and Nanotechnology

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Office hours: Tuesday 2:00 pm, Wednesday 9:00 am. Students can also arrange a time to meet by email or in person.

Lecture schedule: Monday, Tuesday, Wednesday, Friday 11:15 am to 12:05 pm in Tate B50.

Discussion and Laboratory Schedule: Individual student schedules are available at my.umn.edu.

Physics Tutoring Room: TA's will staff the Physics Tutoring Room beginning the second week of classes. The Tutoring Room is the glass-walled room off the Tate Atrium opposite the entrances to Tate B50. The schedule will be posted outside the Tutoring Room.

Class Website: Important class materials are available on the class Canvas website (<https://canvas.umn.edu>).

MIDTERM EXAMS AND FINAL EXAM

There will be 4 Mid-Term exams at times listed on the Course Schedule below. Locations for these exams will be announced in class. The Final Exam will be Saturday, May 11, 2019 at 6:30 to 9:30 pm. The location will be announced in class. If you have a conflict with the final exam, you need to request a make-up exam. The procedure for doing that will be announced later in the semester.

REQUIRED MATERIALS

The text is Eric Mazur, *Principles and Practice of Physics*, 1st edition, Vol. 2, Chapters 22-32. This book is organized as two volumes. One is *Principles* and the other is *Practice*. The chapters in the two volumes are coordinated. You are **strongly** suggested to purchase the custom version of the textbook at the University Bookstore for two reasons: (1) The custom version includes an access code for *Mastering Physics (MP)*, which is also required. [If you were enrolled in Physics 1301 Fall Semester, your MP account for 1301 is still valid. You do not need a new access code.] (2) The negotiated price for the package is less than you can find legally elsewhere, including the web.

Access code for *Mastering Physics* homework system, as described above. The course code for MasteringPhysics is PH1302300S2019.

This class will utilize the LearningCatalytics (LC) software to facilitate and record class participation as a portion of the grading algorithm. LC is bundled with MasteringPhysics and should be available through the same login.

Quadrille-ruled, hardbound laboratory notebook. Free download of Lab Manual from Canvas website.

COURSE GOALS AND OBJECTIVES

Physics 1302 is the second course of a two or three-semester sequence (1301, 1302, 2503) providing an overview of 21st Century physics from the perspective of students interested in science and engineering. Physics is the study of matter, energy and their interactions, everywhere in the knowable Universe. The primary focus of Physics 1301 is Mechanics. The primary focus of Physics 1302 is Electromagnetism. Physics 2503 explores physics principles and applications further, with an emphasis waves, optics and special relativity.

21st Century physics is a science based on principles rather than on taxonomy. Its goals are to describe the behavior of the Universe in terms of a few (and perhaps ultimately one) general principles. The goals of this course are to help you reach the educational objectives of your major by:

- Building your understanding of how natural phenomena in the Universe can be understood, and often predicted, in the context of a few basic principles;
- Improving your ability to conceptualize natural phenomena, using appropriate physics principles and mathematical models;
- Giving you practice in the use of mathematical models to make quantitative predictions about the behavior of physical systems in the Universe;
- Increasing your skill in making measurements of physical properties;
- Providing an opportunity to practice communicating technical information in an organized and readily understandable way.

WHAT YOU NEED TO DO FOR PHYSICS 1302

- Come to class Monday, Tuesday and Wednesday and Friday (see detailed Class Schedule below)
- *Before Class*: Read the sections of the textbook assigned on the Class Schedule.
- *During Class*: Listen, think, discuss, ask questions, do problems and report answers using LearningCatalytics. *You are encouraged to work with students sitting near you to solve the in-class problems.*
- Participate in problem sessions on Thursdays ready to work in groups on a problem that will be handed out in class. **Attendance at problem-solving sessions is required.** If you have an excused absence, you must discuss with your TA making up the missed work. If you are late more than 10 minutes, you are considered absent. Your score on the next exam group problem will be reduced by half for each unexcused problem-solving session absence. If you are more than 10 minutes late for an Exam Group Problem, you will need to do the group problem by yourself.
- Appear on time for your assigned lab section ready to work with your lab partners to make observations and measurements regarding physical phenomena that are discussed in class. Your lab

instructor will provide additional information about lab write-ups (required because this class is listed as *writing-intensive*). The Lab Schedule is listed in the Physics 1302 Lab Syllabus.

- Answer the assigned Pre-Class Questions using *Mastering Physics*.
- Do the assigned weekly homework problems using *Mastering Physics*.
- Take four Mid-Term Exams on Thursdays/Fridays (see Class Schedule below) and one Final Exam. The Thursday section of the Mid-Term Exams will be a group problem, done in class. It will count for 25% of your total grade for the Mid-Term exam. The Friday section of the Mid-Term Exams (75% of the total grade) will be done individually. For both the Mid-Term Exams and the Final Exam, you can use one handwritten 8½ inch by 11 inch (double-sided) sheet of equations. You can also use a simple calculator, but graphing calculators cannot be used during exams.

PHYSICS 1302 LABORATORY

Because this course satisfies University requirements as a laboratory science class and as a writing intensive course, you must pass the laboratory (60% of the possible score) to receive a passing grade in the course. The laboratory grade will be based on pre-lab quizzes, well thought out predictions, collaborative skills as evidenced by effective group work and a well-organized and correctly written technical communication of the physics concepts of this course in your laboratory journal and laboratory reports.

You will write several laboratory reports. **The specific part of the laboratory for which you will write a report will be assigned to you by your instructor at the end of each laboratory topic (about every two weeks).** Reports should be about 4 typed pages. The reports must be printed (the University supplies word processor facilities if you do not have your own) and include all necessary predictions, graphs, data tables, and calculations. **Reports must be given to your laboratory instructor for grading by the deadline set by your Lab Instructor, generally one week after they are assigned. Late reports will not be accepted.** Graded reports will be returned to you about one week after submission and may be revised, only with instructor permission, to achieve a higher grade. If a revised report is allowed, it must be given to your laboratory instructor by the deadline set by your Lab Instructor. Details of the laboratory grading are in your laboratory manual.

Read the relevant portions of the lab manual before attending a lab. Each lab has several sections, your TA will tell you which sections to have prepared each week. All the laboratory problems have sections called Prediction and Method Questions. You should hand in your answers to these sections by the deadline specified by your Lab Instructor.

Failure to participate in the laboratory will result in a laboratory grade of 0 for that topic. Since the laboratory involves teamwork, no laboratory makeup will be allowed except in situations officially recognized by the University. In that case, the laboratory work must be made up by arrangement with your TA before your next scheduled laboratory period. The lab is done in the same small groups as the discussion sections, which are changed periodically. Lab data is taken cooperatively, but **you are responsible for writing your own reports**. Unexcused absences or lateness by more than 10 minutes will result in a zero grade for any lab report required for that lab.

MATHEMATICS

21st Century physics is highly dependent on mathematical models for quantitative results. Success in Physics 1302 will require you to develop and apply mathematical skills. The most important skill is the ability to describe a physical context in terms of a mathematical model. Geometry and trigonometry are particularly important. Modeling dynamically changing systems will require differential calculus. Aggregating individual effects will utilize integral calculus. If you are taking Calculus I or II concurrently, you will likely encounter some mathematical techniques in physics **before** you see them in your math class. For that reason, Physics 1302 will include some topics in mathematics, particularly in differential, integral and multivariable calculus and differential equations.

PROBLEM-SOLVING GROUPS

Science and technology in the world today is generally done in collaborative groups. For that reason, much of the work in this class will be done in groups. You are **strongly encouraged** to develop informal problem-solving/study groups with other people in this course. Research on study groups suggests mixed gender groups work best and all-male groups are the least effective. The most effective group size is likely 3 or 4 people.

LIBERAL EDUCATION

The class exposes the student to physical principles and concepts, demonstrates how these principles can be applied to quantitatively describe natural phenomena, and provides the student with an opportunity to perform hands-on experiments and measurements that model how physical knowledge is obtained. The fundamental principles of electricity and magnetism are explored and the application of these physics concepts in modern technology is emphasized. The development of conceptual understanding of physical principles and their quantitative application are further deepened in the discussion section, where students practice problem solving skills. In addition, familiarity with the methods and findings of the physical sciences not only forms a crucial component of a common education, but also prepares students to be scientifically literate citizens.

Because all knowledge in the physical sciences is empirically acquired, the laboratory component of the course is essential to properly expose students to the scientific method and the ways of knowing and thinking in the physical sciences. The lab component involves the formulation of scientifically sound predictions by the student, followed by empirical testing of the hypotheses through hands-on

experimentation. Since the language of the physical world is mathematical, quantitative analysis of experimental data is an essential aspect of the lab experience. Physics, like all sciences, is a social endeavor, and students are exposed to cooperative problem solving, working in small groups with other students, in both the laboratory and discussion sections of the course.

GRADING

For exam times, see course schedule below.

The median course grade will be in the B/B+ range. The grading basis is as follows:

Lab reports and participation: 20%

Homework (submitted via Mastering Physics): 10%

Pre-Class Quizzes (submitted via Mastering Physics): 5%

Class Participation (via LearningCatalytics): 5%

Exam Scores: 60%

Exam scores will be calculated by two methods and you will be given the higher score.

Method 1: 4 Midterm Exams 10% each; Final Exam 20%

Method 2: Three highest midterm exam scores: 10% each; Final Exam 30%

Course letter grades will be assigned based on numerical grades as follows:

≥88 A; ≥85 A-; ≥82 B+; ≥79 B; ≥75 B-; ≥70 C+; ≥60 C; ≥50 C-

EXAM RE-GRADES

If the exam grader has made an error in their application of the grading rubric, you may request a re-grade on an exam problem. To request a regrade:

- Read the grader's notes online.
- Fully understand the problem, the physics and the grading rubric.
- Write your grievances on a separate piece of paper, **not on the graded problem**.
- Staple your explanation paper to the graded problem.
- Return this to your TA **within two weeks** of when your graded exams were returned to you. Your TA will give your re-grade request to the original grader.

Your comments should be one paragraph or less. Students who find that they need more than half a page to explain their grievances typically don't have a good case and end up getting their re-grade request denied. Each grader has a rubric that should have been applied to all students in a uniform manner. You may dispute the grader's application of this rubric to your exam, but not the rubric itself. Don't try to explain what you were thinking when you took the exam or argue that you, "understood the physics, but my answers were wrong because of X, Y, Z." Grading exams is not an exercise in mind reading; we can only grade what's written (legibly) on the page. Also, be aware that your exam will be under extra scrutiny and the grader may discover that their rubric was applied inconsistently to your solution so that a correct grading **lowers your score** (fortunately, this is rare).

You must assert your concern within 2 weeks after any exam otherwise your grade will not be changed.

ATTENDANCE POLICY

Lecture: Attendance is strongly encouraged and will affect Class Participation score, but is not required. Lecture slides will be available on the class website.

Discussion: Attendance at Discussion sections is required. Unexcused absences will affect exam group problems.

Lab: Attendance is required. Unexcused absences will affect Lab score.

QUESTIONS AND CONCERNS

You are welcome to address your questions or concerns to the course instructors and/or the Teaching Assistants in person, by email or by telephone. **The goal of this course is to improve your knowledge and understanding of physics.** If something is interfering with that goal, you need to make your concerns known to somebody who can address them.

DEPARTMENTAL POLICIES

ATHLETES must provide their official University of Minnesota athletic letter containing the approved competition schedule to their instructor and the staff in office 148. Away exams will be arranged with the athletic adviser traveling with the team. Accommodations will be made for official university sports only (i.e. no accommodations will be made for intramurals, club sports, etc.)

DISABILITY SERVICES: If you have accommodations for this course, please provide the staff in office 148 with a copy of your accommodation letter for the current semester. Exams will be arranged according to accommodations and sent to the testing center for administration.

OTHER POLICIES: The policies described in detail by the following links are also included in this Syllabus.

- **Student conduct code**
http://www1.umn.edu/regents/policies/academic/Student_Conduct_Code.html
- **Scholastic Dishonesty**
See student conduct code
- **Disability Accommodations**
<http://ds.umn.edu/student-services.html>
- **Use of Personal Electronic Devices in the Classroom**
<http://policy.umn.edu/Policies/Education/Education/CLASSROOMPED.html>
- **Makeup Work for Legitimate Absences**
<http://policy.umn.edu/Policies/Education/Education/MAKEUPWORK.html>
- **Appropriate Student Use of Class Notes and Course Materials**
<http://policy.umn.edu/Policies/Education/Education/CLASSNOTESSTUDENTS.html>
- **Grading and Transcripts**
<http://policy.umn.edu/Policies/Education/Education/GRADINGTRANSCRIPTS.html>
- **Sexual Harassment**
<http://www1.umn.edu/regents/policies/humanresources/SexHarassment.html>
- **Equity, Diversity, Equal Opportunity, and Affirmative Action**
http://www1.umn.edu/regents/policies/administrative/Equity_Diversity_EO_AA.html
- **Mental Health and Stress Management**
<http://www.mentalhealth.umn.edu>

COURSE SCHEDULE

Week/Date	Monday	Tuesday	Wednesday	Thursday	Friday
#1/1.21	MLK Day No Class	1. Electric Charge, Coulomb's Law Ch. 22	2. Applications Ch. 22	Problem Session Ch. 22	3. E Field (Vectors) Ch. 23
#2/1.28	4. E Field (Vectors) Ch. 23	5. E Field Ch. 23	No Class	Problem Session; Ch. 23	No Class
#3/2.4	6. Dipoles Ch. 23	7. E-Field Lines Ch. 24	8. Flux Ch. 24	Problem Session Ch. 24	No Class
#4/2.11	9. Gauss' Law Ch. 24	10. Gauss' Law Ch. 24	11. Electric Potential Ch. 25	Group Exam 1	Exam 1 (Ch. 22-24)
#5/2.18	12. Potential Energy Ch. 25	13. Potential Difference Ch. 25	14. Potential Difference Ch. 25	Problem Session Ch. 25	No Class
#6/2.25	15. Capacitors Ch. 26	16. Capacitors Ch. 26	17. Dielectrics Ch. 26	Problem Session Ch. 26	18. Batteries, Photovoltaics, Ch. 26
#7/3.4	19. Current Ch. 31	20. DC Circuits Ch. 31	21. Kirchoff's Laws Ch. 31	Group Exam 2	Exam 2 (Ch. 25, 26)
#8/3.11	22. Kirchoff's Laws Ch. 31	23. RC Circuits (Not in Mazur)	24. RC Circuits (Not in Mazur)	Problem Session Ch.31, RC Circuits	No Class
#9/3.18	Spring Break	Spring Break	Spring Break	Spring Break	Spring Break
#10/3.25	25. Magnetism Ch. 27	26. Magnetic Force Ch. 27	No Class	Problem Session Ch. 27	No Class
#11/4.1	27. Magnetic Force Ch. 27	28. B Field Ch. 28	29. B Field (Biot-Savart) Ch. 28	Group Exam 3	Exam 3 (Ch. 27, 31)
#12/4.8	30. B Field-Ampere Ch. 28	31. B Field-Dipoles Ch. 28	32. B Materials (not in Mazur)	Problem Session Ch. 28, 29	33. Faraday's Law Ch. 29
#13/4.15	34. Faraday's Law Ch. 29	35. Inductance Ch. 29	36. B Field Energy Ch. 29	Problem Session Ch. 29	No Class
#14/4.22	37. Displacement Current Ch. 30	38. EM Waves Ch. 30	No Class	Group Exam 4	Exam 4 (Ch. 28, 29)
#15/4.29	39. EM Energy Ch. 30	40. Alternating Current Ch. 32	41. AC Circuits Ch. 32	Problem Session Ch.30,32	
#16/5.6	42. LRC Circuits Ch. 32				

Lab Schedule:

Week 1: Introduction

Week 2: I.2 E Field Vectors

Week 3: I.4, 5 E Field Force

Week 4: II.1, 2 Field Potential

Week 5: II.3, 4 E Field Potential

Week 6: III.1 Capacitor Energy

Week 7: III.2, 4 Capacitors

Week 8: IV-8, 9 Circuits

Week 9: Spring Break

Week 10: IV.4, 10 Kirchoff's Law

Week 11: V.2, 3

Week 12: V.8 B Force

Week 13: V.5

Week 14: VI.5, 6

Week 15: Wrap-Up