PHYSIC 113 Fundamentals of Physics I **Fall 2021**

Instructor:	Olga Goulko	Lectures:	Tu&Th 4-5:15pm, Y02-2300
Office hours:	Tu&Th 10:30am-noon	Discussions:	Tu 2-3:15pm, Th 2-3:15pm,
Office:	ISC-1-1180		Fri 11-12:15pm
Email:	`olga.goulko@umb.edu`	Homework due:	Fri, by 2pm Eastern time

This is the first part of a two-semester, calculus-level, introductory course in basic physics, intended for students in the physical sciences, engineering, biochemistry, computer science and mathematics. We will cover topics in classical mechanics, wave motion, and heat. You should bring to the course an elementary but working knowledge of arithmetic, algebra, geometry, trigonometry, and calculus.

This course places significant emphasis on qualitative and conceptual physical reasoning as a complement to the mathematical quantitative aspects. You are expected to take a very active participation in the class. One of our main goals is learning to solve problems in physics. Some problems will be solved and discussed together in class. The course is intended to give a solid preparation in classical mechanics, and also to prepare the students for the courses on thermal and modern physics.

Calculus (MATH 140) is a co-requisite. PHYSIC 181 (laboratory course) is a co-requisite for Physics majors. Credits: 4

Expected student learning outcomes

- Acquiring a solid understanding of the fundamental concepts and laws of classical mechanics.
- Demonstrating critical thinking and analytical reasoning ability.
- Being able to use algebra, trigonometry, and calculus to set up mathematical descriptions of physical systems.
- Being able to solve problems in classical mechanics, to calculate measurable quantities, and to interpret the physical results.

Book suggestions

There is no required textbook, but you are strongly encouraged to read more about the material in textbooks and to make use of additional resources. Lectures are based on the book

- "Fundamentals of Physics: Mechanics, Relativity, and Thermodynamics" by R. Shankar, Yale University Press, ISBN-10: 0300192207.

Additional helpful books include

- "Fundamentals of Physics" (Part I) by Halliday, Resnick, and Walker, John Wiley and Sons (any edition).
- "The Art of Insight in Science and Engineering" by Sanjoy Mahajan, MIT Press (2014), open access at `https://mitpress.mit.edu/books/art-insight-science-and-engineering` (great book on how to think like a physicist, numerical estimation, etc.)
- "The Feynman Lectures on Physics, vol 1" by Feynman, Leighton, and Sands, Addison Wesley (for deeper understanding).

In addition, course lecture notes will be published on the BlackBoard site.

Lectures and Discussions

Attendance of all classes is expected and active participation in lectures and discussions is evaluated and counts towards the final grade. The participation score is based on both attendance and interaction during both lectures and discussion sessions – including discussion of problems at the board. Constructive questions and comments in class earn points added to your participation score.

The discussion sessions will be less formal than the lectures with main focus on problem solving. We will also review the course material and homework, especially the more difficult topics. The discussions will help you solidify your knowledge and to solve the homework assignments.

All students who are registered for the course will have access to the BlackBoard page. Weekly updates and additional course announcements will be posted on Blackboard and sent via email. **Please make sure to check BlackBoard and your email regularly.**

In addition to the lectures and discussions we will offer several supplemental instruction (SI) sessions to be conducted in person or over Zoom. They will cover additional problems and review particularly challenging aspects of the material. The times and locations of the SI sessions will be decided at the beginning of the semester. While the SI sessions are voluntary you are strongly encouraged to attend, especially if you feel like you might be falling behind. You will receive 3% extra credit if you attend at least 80% of the offered SI sessions.

Homework

There will be weekly homework assignments, which will be posted on BlackBoard on Fridays and are due on the following Friday by 2pm Eastern time, unless otherwise specified on the assignment sheet. Homework has to be returned written or printed on normal sized paper and stapled correctly. Alternatively, you may scan/photograph your work and upload it to the BlackBoard site. It is very difficult to grade homework that is hard to read, so it is to your advantage to write in a clear way.

Homework is graded within two weeks from its due date. The grades will be entered to BlackBoard. Please address questions about the homework and its grading to the TA: Ben Moss, `Benjamin.moss002@umb.edu`

You are expected to work out the solution of homework assignments independently. However, discussions among students are encouraged, as long as the final outcome comes from your original effort. **No late assignments will be accepted under any circumstances,** but the worst two assignments will be excluded from your final grade.

Exams

There will be two midterm exams (Tuesday, October 12 and Tuesday, November 9, during the regular lecture time) and a comprehensive (all inclusive) final exam during the finals slot assigned for this course. All exams are closed book, closed notes, but one letter-sized hand-written cheat sheet is allowed. There are no makeup exams.

Grading

The course grade will be calculated as follows:

- homework: 30%
- participation: 10%
- two midterm exams: 30% (15% each)
- final exam: 30%

Course grade percentages:

A:	$\geq$93%	A-:	92.99%-90%	B+:	89.99%-87%	B:	86.99%-83%
B-:	82.99%-80%	C+:	79.99%-77%	C:	76.99%-73%	C-:	72.99%-70%
D+:	69.99%-67%	D:	66.99%-63%	D-:	62.99%-60%	F:	$<$59.99%

The grade incomplete (INC) can be given only to students in otherwise good standing when a portion of the required class work, or the final examination, has not been completed because of serious illness, extreme personal circumstances, or scholarly reasons at the request of the instructor. Please see `https://www.umb.edu/registrar/policies` for additional information, as well as for the pass/fail/withdrawal deadlines.

Accommodations

UMass Boston is strongly committed to providing reasonable academic accommodations for all students with disabilities. Please contact the Ross Center for Disability Services (`ross.center@umb.edu`, 617-287-7430) for recommendations for specific accommodations if needed. If you already have a recommendation, please contact me as soon as possible, preferably within the first two weeks of classes, so that we can work out the best way to support you.

Student mental health

If you or someone you know experiences academic stress, difficult life events, or feelings of anxiety or depression, we encourage you to seek support. Helpful, effective resources are available via the University Health Services. The UHS Counseling Center can be reached at 617-287-5690 (including after-hours and on weekends). Whether or not you are a current patient at the center, you will be able to access telehealth crisis support. More information is available online at `https://www.umb.edu/healthservices/counseling_center`

Student conduct

Students are required to adhere to the University Policy on Academic Standards and Cheating, to the University Statement on Plagiarism and the Documentation of Written Work, and to the Student Code of Conduct. The Student Code of Conduct and Instructional Setting Conduct Policy are available online. **All attempts at cheating will be automatically reported.**

Course topics

The topics and timing may change as the semester develops.

Week	**Content**
Week 1	Lectures: What is physics? Space, time, matter. Review of calculus, vectors. Discussion Sessions: Estimates, dimensional analysis, limits and derivatives.
Week 2	Lectures: Kinematics in one and two dimensions. Discussion Sessions: More on vectors, calculus, and exercises in kinematics.
Week 3	Lectures: Dynamics, inertia, the concept of force, Newton's laws. Discussion Sessions: Applying Newton's laws.
Week 4	Lectures: Different types of forces (elastic, gravity, friction, inertial forces). Discussion Sessions: Exercises on above topics.
Week 5	Lectures: Energy, work, potential, power. Energy conservation. Discussion Sessions: Exercises on above topics. Review for first midterm.
Week 6	**First midterm** (Tuesday, October 12) Lectures: The Kepler problem. Discussion Sessions: Exercises on above topics.
Week 7	Lectures: Systems of particles: center of mass, momentum, collisions. Discussion Sessions: Exercises on above topics.
Week 8	Lectures: Rigid bodies: rotational motion and angular momentum. Discussion Sessions: Exercises on above topics.
Week 9	Lectures: Dynamics of a rigid body. Discussion Sessions: Exercises on above topics. Review for second midterm.

Week 10	**Second midterm** (Tuesday, November 9) Lectures: Statics. Discussion Sessions: Exercises on above topics.
Week 11	Lectures: Statics. Harmonic motion. Discussion Sessions: Exercises on above topics.
Week 12	Lectures: Harmonic motion. Discussion Sessions: Exercises on above topics. **Thanksgiving break**
Week 13	Lectures: Waves. Discussion Sessions: Exercises on above topics.
Week 14	Lectures: Fluids. Discussion Sessions: Exercises on above topics. Review and preparation for final exam.
Week 15	Lectures: Other topics. Review. Discussion Sessions: Review and preparation for final exam. **Final exam**