COLLEGE OF DUPAGE

Physics 2111-002: Physics for Science and Engineering I Summer 2025

Instructor: Dr. David R. Fazzini *Office:* BIC-3E04-B

Hours: Monday & Wednesday: 3:40PM-4:30PM
Tuesday & Thursday: 10:00AM-12:00 Noon & 3:40PM-4:30PM
(Additional times by appointment.)

NOTE: During some of my office hours, I may be found in the Physics Lab Preparation Room (BIC-3E06) or in one of the adjoining labs (BIC-3E03, -3E05, or 3E07).

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Course Description:

Calculus-based study of classical linear and rotational kinematics and dynamics, including work, energy, impulse, momentum, collisions, gravitation, periodic motion and wave motion. (Students without a strong high school physics background are encouraged to complete PHYSI 1201 before enrolling in this course.) (4 lecture hours, 3 lab hours)

Semester Credit Hours: 5

Prerequisite: MATH 2231 with a C or better or equivalent. (Proof required.)

IAI Course Code: PHY-911 (for majors)

Official Text: Openstax University Physics Volume 1 available free online at:

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

If you prefer, you may use any *calculus-based* introductory physics text of your choice. (Suggested authors: P. A. Tipler & G. Mosca; R. D. Knight; Halliday, Resnick & Walker; G. Gladding, M. Selen & T. Seltzer; just to name a few.)

Lab Manual: Lab Activities provided free online from Physics 2111 Class webpage:

https://cod.edu/faculty/websites/fazzinid/physics-2111-aspx

PRS Keypad: iClicker (provided on loan by instructor).

Material: Chapters 1-17 (Openstax University Physics Volume 1 online textbook)

Location: Lecture: BIC-3535 MTWR: 12:30 PM-3:30 PM
Laboratory: BIC-3F05 MW: 7:30AM-11:50 AM

Course Objectives
Upon successful completion of this course the student should be able to do the following:

1. Describe the relationships among different units of measure
2. Interpret and explain the relationships among an object's displacement, velocity, and acceleration in multiple dimensions
3. Calculate the effect of external forces on an object's motion using Newton's Laws in multiple dimensions
4. Create and label simple free-body diagrams in multiple dimensions
5. Explain and apply the relationship between work and kinetic energy
6. Calculate the effect of external forces on an object's motion using work-energy methods for both conservative and non-conservative forces in multiple dimensions
7. Calculate the effect of both static and kinetic friction on the motion of an object using both force/acceleration methods and work/energy methods
8. Identify and calculate the different forms of energy in classical dynamics (potential, kinetic, and mechanical)
9. Explain and apply the relationship between impulse and momentum
10. Calculate the effect of external and internal forces on a system of objects using impulse and momentum methods in multiple dimensions
11. Identify situations in which a system's momentum is conserved
12. Predict the motion of a system of particles using center-of-mass methods
13. Formulate the outcome of collisions of particles in both elastic and inelastic cases
14. Interpret and explain the relationships among an object's rotational displacement, velocity, and acceleration in multiple dimensions
15. Create and label simple free-body diagrams for rotational situations
16. Formulate the effect of external torques on an object's motion using Newton's Laws in rotational form
17. Identify and calculate the strain of a solid for different applied stresses (tensile, hydraulic, and shearing)
18. Calculate gravitational forces and fields among systems of particles using superposition and integral methods
19. Calculate energies of orbits
20. Calculate kinematical characteristics of an object undergoing simple harmonic motion using the equations of motion for force, position, velocity, and acceleration
21. Describe the relationships among wavelength, period, frequency, angular frequency, angular wave number, and wave speed for a sinusoidal wave
22. Formulate the kinematical characteristics of a sinusoidal wave based on data in both graphical and numerical form
23. Interpret the motion of a sinusoidal wave and explain the superposition principle

24. Calculate the resonant frequencies and wavelengths for both transverse and longitudinal waves
25. Apply the superposition principle to calculate positions of maximum destructive and constructive interference for waves
26. Calculate sound wave intensities and intensity levels
27. Calculate Doppler shifts and beat frequencies

Course Logistics

GENERAL COURSE INFORMATION can be found through the class webpage:

https://cod.edu/faculty/websites/fazzinid/physics-2111-aspx

and the **Blackboard** website:

https://bb.cod.edu/webapps/login/

Check the class webpage and log in to **Blackboard** regularly for general announcements and assignment updates. These sites will provide important announcements and course updates such as reading/online homework assignments and laboratory information. The class webpage will be updated on a regular basis and **Blackboard** will be used for blanket emails and grade dissemination.

READING assignments will be from the OpenStax University Physics (available FREE online). If you prefer, you may refer to any calculus-based introductory physics textbook for the assigned reading material. It is assumed that you have read the assigned material prior to class on the due date.

HOMEWORK assignments will be provided online using the *Expert TA* homework system. You will need to subscribe to *Expert TA* at a nominal cost. You will also need the following access link:

https://login.theexpertta.com/registration/classregistration.aspx?regcode=USG15IL-7AB056-3HS

All of the homework for the entire term has been generated. Assignments open one week before they are due. Check the class webpage regularly for assignment updates.

In addition to the homework described above, short in-class exercises are used to monitor conceptual understanding. (See IN-CLASS POLLING.) These can typically be answered by keeping up with the reading assignments and class discussions. These are designed to surface possible misconceptions and uncover some of the common pitfalls that confuse many students.

Be aware that it is very important that you make an honest attempt to work through the questions, exercises, calculations and problems since working the homework is a primary technique for learning the material. It is also very important that you be able to understand the solutions conceptually rather than just memorizing formulas since the quiz and exam problems generally require you to demonstrate application of the concepts being assessed. Be sure that you can answer any assigned question or solve any assigned problem since those of similar "style" may appear on the exam. It is your responsibility to seek assistance from you instructor and/or other resources if you are having difficulties. Reliance on Chegg, Course Hero, ChatGPT, etc. for the homework generally will not serve your ability to perform well on the exams.

EXAMS will consist of two "1-hour" exams and a "2-hour" comprehensive final exam. The 1-hour exams are of a multiple-choice format. Problems are standardized from homework sets, sample problems from the text, and examples discussed in class or the laboratory. The 2-hour final exam will be a multiple-choice standardized test. All exams are closed book and closed note. However, you will be provided with a sheet of "possibly useful information" that contains formulae, universal constants, conversions, etc. for all exams. See the "Physics 2111 Tentative Schedule" page for exam dates. All exams will start promptly at Noon on the dates indicated:

Exam I:	Wed., June 11th	OpenStax Vol. 1 Chap. 1-6
Exam II:	Mon., June 23rd	OpenStax Vol. 1 Chap. 7-11
Final Exam:	Thurs., July 3rd	OpenStax Vol. 1 Chap. 1-17 (except 14)

Important! You must take the Final Exam on the date scheduled. There are NO make-ups. If you know that you cannot take the Final Exam on Thursday, July 3rd, during class time, then drop this course on Day 1 and get a 100% tuition refund.

QUIZZES consisting a few short questions based upon material covered in the previous unit/chapter will be administered on occasion with warning or without warning. These short questions and exercises are used to monitor conceptual understanding. Quiz questions are typically in a multiple-choice format and answered by conceptual reasoning or with a couple of lines of algebra or explanation. All quizzes are closed book and closed note. No equation sheets will be provided for the quizzes.

IN-CLASS POLLING (iClickers) will be administered to each student during the lectures. using "iClickers" that will be provided on loan to each student. (No need to purchase!). The system will allow you to further interact with the instructor during the lecture. You will be able to respond to questions and give feedback as the course progresses. For instance, short in-class exercises used to monitor conceptual understanding will be administered from time to time. The questions typically consist of surveys, conceptual questions or short calculations and are designed to surface possible misconceptions and uncover some of the common pitfalls that confuse many students. Students are encouraged to participate in small group discussions with classmates while answering these questions. Responses are recorded and scored. The scoring is used to measure class participation and can be used to determine a final grade in borderline situations.

LABORATORY sessions meet twice per week and are required for this course. The laboratory section is designed to provide you with hands-on experiences related to the topics that are discussed in the classroom. The laboratory activities will come from the online manual that will be made available to you. Handouts are provided for any additional activities. (Due to the condensed format of the term, not all the investigations in the manual will be performed.) During the lab, you will make predictions, answer questions, and record observations. Laboratory homework assignments are to be completed during the session and submitted at the end of that laboratory session. Each lab is graded based upon completion of three parts: 1) a completed Pre-lab submitted at the start of the laboratory session (worth 10%), 2) required measurements and "in-lab" questions (worth 45%), and 3) the laboratory homework (worth 45%).

As the laboratory is a required part of the course, your final grade will drop one full letter for every two sessions that are missed regardless of exams/homework/quiz scores. As there are no "make-ups," you are strongly advised to perform and submit all lab assignments.

PRE-LABS for each laboratory session will also be made available from the class webpage for you to print. Each pre-lab consists of a few short questions based on the reading of that week's lab. These are to be completed **prior** to entering the lab for that session. Pre-labs are due at the beginning (7:30 AM) of the lab session. Pre-labs submitted by 7:30 AM for that session is worth 10% of the standard lab grade. The pre-labs **must** be submitted by 1:00 PM to be counted as "on time.". Pre-labs submitted after 1:00 PM are considered late and subject to a 5% penalty on that week's lab grade. Pre-labs not submitted before the end of the session incur a 10% penalty on that day's lab grade.

Tentative Summer 2025 Lab Schedule for Physics 2111
Mechanics Lab (BIC-3F05)

Dates	Lab	
Monday, June 2nd	#1	FCI & Introduction to Motion
Wednesday, June 4th	#3	Changing Motion
Monday, June 9th	#4	Newton's Laws
Wednesday, June 11th	#5	Gravitational Forces
Monday, June 16th	#6	Frictional Forces & Tension
Wednesday, June 18th	#8	Work & Energy
Monday, June 23rd	#10	Conservation of Momentum
Wednesday, June 25th	#11	Static Equilibrium
Monday, June 30th	#12	Periodic Motion
Wednesday, July 2nd	N/A	Universal Gravitation

PARTICIPATION in the course can have a reflection in the overall final grade. Items such as attendance, attitude, sincerity, changes in performance, etc. will be considered in borderline situations.

ATTENDANCE/TARDINESS: In general, formal attendance is recorded by means of "iClickers," submitted quizzes, and officially stamped laboratory work. Students who have missed 3 or more classes or labs AND are not passing with a grade of "C" or better by Tuesday, June 17h, 2025 will be considered in "non-pursuit" and may be administratively dropped from the course by the instructor. Students who do not "click in" during the class or who miss a quiz due to tardiness or any other reason will not necessarily have their attendance recorded.

GRADING is tentatively based on the following breakdown:

Homework:	20%	Grade Cut-offs*
Laboratory:	15%	A: > 90%
Quizzes/Clickers:	10%	B: > 80%
Exam 1:	15%	C: > 70%
Exam 2:	15%	D: > 60%
Final Exam:	25%	F: < 60%

*Depending on other factors involved with the course, it is possible for the grade cut-offs to be lowered by up to 5%, but DO NOT count on it.

ACCOMMODATIONS: The College of DuPage is committed to the equitable access of educational opportunities for students with disabilities in accordance with The Americans with Disabilities Act, As Amended and Section 504 of the Rehabilitation Act of 1973. Any student who feels they may need an accommodation on the basis of an illness, injury, medical condition, or disability should contact the Center for Access and Accommodations to determine eligibility for accommodations and to obtain an official Letter of Accommodation. The Center for Access and Accommodations can be reached via email at

access@cod.edu.

Students may also initiate a request for services by going to

www.cod.edu/access

and clicking on the green box labeled "complete form to request accommodations." If you are already registered with the Center for Access and Accommodations, please email me your Letter of Accommodation as soon as possible. Please DO NOT send any private health documentation or doctor's notes to your instructor.

LATE MATERIAL & MAKE-UPS: All quizzes and exams must be completed on the scheduled date at the time they are scheduled. There are no make-ups for any reason (except jury service or call to military duty). If absent for either "1-hour" exam, then the percentage score of the final exam will be applied to one (and only one) missing exam. All online homework must be submitted by the cut-off time and laboratory homework must be submitted at the end of the lab session (11:50 AM) to receive maximum credit. Any lab not submitted prior to the end of that day's session receives a 20% penalty. After that, the penalty is an additional 20% for every 24 hours past the original due date

and time. After a particular lab is returned, that lab cannot be submitted for credit. (Note that you can receive up to 50% credit just from the completion of the data acquisition and "in-lab" questions as long as it was officially stamped and submitted on time.)

RETURN POLICY: In general, every effort will be made to return work approximately in a timely fashion usually within one week after submission.

CALCULATORS, LAPTOPS & CELL PHONES: Only *TI-30 non-graphing calculators* may be used during exams. These calculators are available for check-out from your instructor and must be returned in order for your exam to be graded. Students are responsible for having the correct calculator for the exams and knowing how to use it. During exams, there is no sharing of calculators and the cover must be removed.

CELL PHONE CALCULATORS may not be used during exams (obviously). Cell phones must be kept in "silent mode" during class or lab. Students may use laptop computers or tablets to take notes during lecture only under the following conditions: 1) the screen must be displayed to the instructor immediately upon request at any given time during the lecture and 2) you show your notes to the instructor at the end of class. If these conditions cannot be met, then you may not use the device in class.

WITHDRAWAL POLICY: The last day to withdraw from this course without petition is Thursday, June 26th, 2025. After that date, students may file a *Petition for Late Withdrawal* through the Registration Office. A *Petition for Late Withdrawal* will be granted for extenuating circumstances only, including student illness, death in the immediate family, family emergencies, call to active duty, or other appropriate extenuating circumstances. The student will be required to provide appropriate documents for all requests for late withdrawal. Prior to withdrawing from this class, students are strongly encouraged to speak to their instructor prior to withdrawing from this class.

As stated earlier, students who have missed 3 or more classes or labs AND are not passing with a grade of "C" or better by Tuesday, June 17th, 2025 will be considered in "non-pursuit" and risk being administratively dropped from the course. (No refunds!)

INCOMPLETE POLICY: Under extraordinary circumstances (such as an extended medical emergency or family tragedy) a student currently earning "C" or better may not be able to complete all of the course requirements. In such instances, the student may petition the instructor for an "incomplete" grade. Only if the instructor deems the request as warranted will a contract agreement be made between the student and instructor as to how the course will be completed. After the contract is signed by both the students and the instructor, the student will receive a grade of "I". Note: The course must be completed with the same instructor and within one calendar year of the end of the term for which the student was enrolled. If the student does not complete the requirements for the course as prescribed in the agreement, the "I" grade will automatically revert to a grade of "F." It is advised that the students be fully aware of the consequences of receiving an incomplete grade and understand the terms described in the COD Catalog and can be accessed at

https://catalog.cod.edu/academic-policies-procedures/

CONDUCT: It is expected that you are aware of and follow the guidelines for conduct as described in the COD Catalog: *Student Rights and Responsibilities*. In particular, *Student Code of Conduct (Board Policy 20-35)*. Individuals that exhibit disruptive behaviors that interfere with the lectures and/or laboratory sessions will be removed from the class so that those individuals who wish to learn physics can do so. Those individuals removed must then conference with either the Dean or an Associate Dean in Natural & Applies Sciences Division. Those individuals may then rejoin the class pending the outcome of the conference.

Anyone caught cheating or plagiarizing will receive an automatic failure for the course. You will not be allowed to drop the class if you are found in violation of this section. It is expected that you are aware of and follow the guidelines for conduct as described in the COD Catalog: *Students Code of Academic Conduct (Board Policy 20-41)* and that you are aware of the definitions of the terms described therein. Also, the college will not tolerate discrimination or harassment. It is also expected that you are aware of and follow the guidelines for conduct as described in the COD Catalog: *Prohibition of Discrimination, Harassment and Sexual Harassment (Board Policies 15-10 and 15-11)*. The policies described in this section can be accessed at

https://catalog.cod.edu/student-services-general-student-information/

DISRUPTIONS: The proprietor of any cell phone or other device that is heard to go off in class or the laboratory ensures him/herself a "0" on the next quiz. Disruption during an exam will result in 5-point deduction off that exam score. Individuals that exhibit disruptive behaviors that interfere with the lectures and/or laboratory sessions will be removed from the class so that those individuals who wish to learn physics can do so. Those individuals removed must then conference with the Dean of the STEM Division. Those individuals may then rejoin the class pending the outcome of the conference.

COMMUNICATION: You should use email or phone as methods to communicate with me if my office hours conflict with your schedule. You are strongly encouraged to ask questions about the syllabus during class time and office hours. For more in-depth discussions (such as guidance on assignments) in-person meetings are available. It is also possible to set up a one-on-one Zoom meeting if a face-to-face meeting is not feasible. Such guidance conversations should take place in person or over the phone rather than through email. This allows us to communicate more effectively and fosters a more collegial learning atmosphere.

RELIGIOUS OBSERVANCE: The College will reasonably accommodate the religious observances of individual students with respect to class attendance, and the scheduling of examinations and class requirements. The student should notify the instructor well in advance of any anticipated absence or a pending conflict between a scheduled class and the religious observance.

Physics 2111 TENTATIVE SCHEDULE for Summer 2025 Semester

Classes start on Monday, June 2nd

Week	Date	Chapter	Topic(s)
1	June 2nd	1	General Measurement & Intro to Motion
	June 3rd	2 & 3	Vectors & Motion in One Dimension
	June 4th	4	Motion in Two & Three Dimensions
	June 5th	5	Newton's Laws of Motion
2	June 9rd	6	Applications of Newton's Laws
	June 10th	6	Friction & Centripetal Force
	June 11th	Ex. I & 7	Chapters 1-6; Work
	June 12th	8	Conservation of Energy
3	June 16th	9	Center of Mass, Momentum & Impulse
	June 17th	10	Rotational Dynamics
	June 18th	11	Angular Momentum
	June 19th	NO CLASS	JUNETEENTH HOLIDAY
4*	June 23rd	12	Equilibrium & Elasticity
	June 24th	Ex. II & 15	Units 7-11; Simple Harmonic Motion
	June 25h	15	Simple & Physical Pendula
	June 26th	16	Travelling & Standing Waves
5	June 30th	17	Sound Waves
	July 1st	13	Universal Gravitation
	July 2nd	Review	Chapters 1-16 (except 14)
	July 3rd	Final Exam	Chapters 1-16 (except 14)

* No classes on Thursday, June 19th due to the Juneteenth holiday.

NOTE: Not every topic in the each assigned chapter may be discussed in class. However, you are responsible for every topic in each assigned chapter unless otherwise stated. If you are having trouble with a topic that is not discussed in class, it is your responsibility to seek out the instructor and/or other resources to ensure understanding of that topic.

Disclaimer:

To the best of the instructor's knowledge, the information in this syllabus was correct and complete at the start of the semester. However, the instructor reserves the right, acting within the policies and procedures of the College of DuPage, to make changes in course content, instructional techniques or grading policy during the term. (Any changes would always be in favor of the class as a whole.)

It is assumed that you have read this course syllabus. Your continued enrollment in this course means that you accept the terms and conditions outlined in this syllabus.

COURSE EXPECTATIONS
Physics 2111
Dr. Fazzini

What Dr. Fazzini Expects from You:

- You will have read the syllabus.
- You will be punctual to class.
- You do not make or receive telephone calls or text messages during class or lab sessions.
- You demonstrate respect for what I and your fellow students have to say.
- You will come to class prepared (pencils, calculator, etc.)
- You will come to class ready to ask and answer questions of substance on the day's topic(s).
- You will concentrate exclusively on this course during the class hours of this course.
- You will notify me prior to class if you have to leave early.
- You will "check your entitlement at the door" and take responsibility for your own learning.

What You Can Expect from Dr. Fazzini:

- I will be punctual to class.
- I will give each of you a fair share of my attention.
- I will work to make the class interesting and relevant.
- I will make myself available as a helpful resource outside of class.
- I will work to help you learn the material and perform at your best.
- I will be the sole arbiter of partial credit.
- I will grade the QUALITY of your work rather than the amount of time and effort you spent on it. (In other words, you will be assessed on your demonstrated performance rather than on anecdotal testimony.)

Detailed Topical Outline:

General measurement
- Units of measurement
- Change of units and compound units

Motion in one dimension
- One-dimensional kinematics (position, velocity, and acceleration)
- Average and instantaneous kinematics
- Relations between kinematic variables
- Special cases of constant velocity and constant acceleration

Vectors and vector operations
- Vectors and vector algebra
- Commutivity and associativity for addition and subtraction
- Resolution and vector components
- Multiplication by a scalar
- Vector operations and components
- Scalar (dot) products and vector (cross) products

Motion in two and three dimensions
- Position, velocity and acceleration as vectors
- Two and three dimensional kinematics
- Projectile motion
- Uniform circular motion and centripetal acceleration
- Relative motion

Force and motion
- Dynamics and Newton's laws of motion
- Inertial mass
- Principle of linear superposition
- Applications of Newton's laws (weight, tension, and normal forces)
- Static and kinetic friction
- Radial and tangential components of acceleration

Energy and work
- Work-energy theorem
- Calculation of work done by multiple forces
- Applications of the work-energy theorem
- Conservative and non-conservative forces
- Power
- Conservative and non-conservative forces and potential energy
- Gravitational and spring potential energies
- Conservation of mechanical energy
- Applications of energy conservation
- Graphical representation of energy conservation

Systems of particles
- Measurement and calculation of the position of the center of mass
- Velocity and acceleration of the center of mass
- Relative motion and frames of reference
- Galilean transformation equations
- Review of Newton's laws for macroscopic body motion

Impulse and momentum
- Impulse-momentum theorem for one and two or more particles
- Conceptual meaning of impulse
- Net impulse, internal forces, and momentum conservation
- Vector momentum conservation
- Applications of momentum conservation

Collisions
- Elastic collisions
- Inelastic collisions
- Macroscopic motion and the center of mass
- Collisions in two dimensions

Rotational kinematics
- Kinematics and dynamics of a particle
- Simple applications of particle rotational dynamics
- Rotational dynamics for a rigid object

Rotational dynamics
- Definition of moment of inertia and net external torque
- Applications of rotational dynamics
- Rotational kinetic energy and energy conservation
- Angular momentum conservation

Equilibrium and elasticity
- Requirements for mechanical equilibrium
- Examples of equilibrium
- Elasticity of materials
- Stress-strain relationships

Gravitation
- Newton's law of universal gravitation
- Superposition
- Gravitational potential energy

Oscillations
- Hooke's law and simple harmonic motion (SHM)
- Examples of SHM
- Damped and forced harmonic motion

Waves

- Waves and their mathematical description
- Speed of a string wave
- Sinusoidal waves and wave trains
- Superposition principle and standing waves
- Longitudinal and transverse waves
- Waves in two and three dimensions
- Interference of waves
- Intensity and intensity level
- Doppler shift and beat frequency