COLLEGE OF DUPAGE

Physics 2111-002: Physics for Science and Engineering I Summer 2022

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

Hours: Monday & Wednesday: 10:15AM-11:50AM & 3:00PM-4:00PM
Tuesday & Thursday: 3:00PM-4:00PM
(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).

Phone: 630-942-3349 *E-mail:* fazzinid@cod.edu

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Course Description: Semester Credit Hours: 5

Calculus-based study of classical linear and rotational kinematics and dynamics including work, energy, impulse, momentum, collision, gravitation, periodic motion and wave motion.

IAI Course Code: PHY-911 (for majors)

Prerequisite: Mathematics 2231 or equivalent with a grade of "C" or better. (Proof required.)

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: Available free online from Physics 2111 Class webpage:

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

PRS Keypad: iClicker (provided by instructor).

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

Location: Lecture: BIC-3535 MTWR: Noon-3:00pm
Laboratory: BIC-3F05 TR: 7:30am-11:55am

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 lablel 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 **Blackboard** website:

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

and the class webpage:

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

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 announcements, blanket emails and grade dissemination.
READING and HOMEWORK assignments will be provided online using the *FlipItPhysics* homework system found at the following URL below:

https://www.flipitphysics.com/Account/LogOn?ReturnUrl=%2f

You will need to subscribe to *FlipItPhysics* at a nominal cost. You will also need the following (case sensitive) access key: **2111Su22FD**. All of the homework for the entire term has been generated. Assignments open one week before they are due. Check the *FlipItPhysics* calendar regularly for assignment updates.

It is assumed that you have read the assigned material by the due date. There are reading (gold) assignments, *Pre-lecture* (blue) assignments, *Checkpoint* (green) assignments, and Warm-ups (red) that are due by **7:00 AM for Tuesday and Thursday** due dates and **11:30 AM for Monday and Wednesday** due dates. There are also *Homework* (also red) assignments that are due by **11:30 PM** on the due date for maximum credit unless otherwise announced. Any part of any *Homework* (red) assignment submitted within 24 hours after the initial cut-off time of the due date will receive a maximum of 50% credit. After 24 hours from the initial cut-off time, you can no longer submit answers to the homework exercises & problems for credit. (The 24-hour 50%-credit does not apply to the blue *Pre-lectures*, green *Checkpoints*, or red *Warm-ups*.)

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.

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, 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:	Thurs., June 9th	OpenStax Vol. 1 Chap. 1-6
Exam II:	Wed., June 22nd	OpenStax Vol. 1 Chap. 7-11
Final Exam:	Thurs., June 30th	OpenStax Vol. 1 Chap. 1-17 (except 14)

Important! You must take the exams at the times and dates scheduled. There are NO make-ups. If you know that you cannot take the Final Exam on Thursday, June 30th, from 12:00 Noon-3:00pm, 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 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 will be administered occasionally during the lectures using "iCLICKERS" that will be provided on loan to each student. 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. These questions can generally be answered by keeping up with the reading assignments and class discussions. 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 grades 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 by 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 not to attend sessions and submit all lab assignments.

Tentative Summer 2022 Lab Schedule for Physics 2111
Mechanics Lab (BIC-3F05)

Dates	Lab	
Tuesday, May 28th	#1	FCI & Introduction to Motion
Thurs., May 30th	#3	Changing Motion
Tues., June 4th	#4	Force, Mass & Acceleration
Thurs., June 6th	#5	Gravitational Forces
Tues., June 11th	#6	Frictional Forces & Newton's Laws
Thurs., June 13th	#7	Work & Energy
Tues., June 18th	#9	Collisions: Force, Impulse & Momentum
Thurs., June 20th	#10	Equilibrium
Tues., June 25th	#13	Periodic Motion
Thurs., June 27th	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. As stated in above, students who have missed 3 or more classes or labs AND are not passing with a grade of "C" or better by Thursday, June 16th, 2022 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:

Pre-lectures & Checkpoints:	10%	Grade Cut-offs*
Post-Homework:	10%	A: > 90%
Laboratory:	15%	B: > 80%
Quizzes/Clickers:	10%	C: > 70%
2 Hourly Exams:	15% each	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.

Miscellaneous:

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 me

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. 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 (11:55 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 any major exam. These calculators are available for check-out from the Math Assistance Center and the Library. However, due to possible high demand, students should not depend on them being available at the time of an exam. Students are responsible for bringing the correct calculator to the exams and knowing how to use them. The cover must be removed from the calculator at all times during the exam. There is no sharing of calculators during exams and NO CELL PHONES CALCULATORS may be used during exams (obviously).

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 on demand 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.

The proprietors of any cell phone or other device that are heard to go off in class or the lab ensure themselves a "0" on the next Quiz. Disruption during an exam will result in a 5-point deduction off that exam score (10-point deduction if during the final exam).

WITHDRAWAL POLICY:
The last day to withdraw from this course without petition is Saturday, June 25th 2022. 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 documentation 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.

Students who have missed 3 or more classes or labs AND are not passing with a grade of "C" or better by Thursday, June 16th, 2022 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, p. 111: *Incomplete Grade*.

CONDUCT:
It is expected that you are aware of and follow the guidelines for conduct as described in the COD Catalog, p. 162-163: *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 the Dean STEM 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, pp. 163-164: *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, page 167: *Prohibition of Discrimination, Harassment and Sexual Harassment (Board Policies 15-10 and 15-11).*

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 as a method to communicate with me. 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) face-to-face are available. Also, it is possible to set up a one-on-one meeting in Blackboard Collaborate or Zoom if necessary. 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.

Physics 2111 TENTATIVE SCHEDULE for Summer 2022 Semester

Classes start on Tuesday, May 31st

Week	Date	Chapter	Topic(s)
1*	May 31st	1	General Measurement & Intro to Motion
	June 1st	2 & 3	Vectors & Motion in One Dimension
	June 2nd	4	Motion in Two & Three Dimensions
2	June 6th	5	Newton's Laws of Motion
	June 7th	6	Applications of Newton's Laws
	June 8th	6	Friction & Centripetal Force
	June 9th	Ex. I & 7	Chapters 1-6; Work
3	June 13th	8	Conservation of Energy
	June 14th	9	Center of Mass & Momentum
	June 15th	9	Collisions & Impulse
	June 16th	10	Rotational Dynamics
4	June 20th	11	Angular momentum
	June 21st	12	Equilibrium & Elasticity
	June 22nd	Ex. II & 15	Units 7-11; Simple Harmonic Motion
	June 23rd	15	Simple & Physical Pendula
5	June 27th	16	Travelling & Standing Waves
	June 28th	17	Sound Waves
	June 29th	13	Universal Gravitation
	June 30th	Final Exam	Chapters 1-16 (except 14)

* No classes on Monday, May 30th due to the Memorial Day 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, iClicker, 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