PHY300 - Mechanics

SECC - 209, MWF - 1:00 - 1:50 PM

West Chester University

Fall 2022

Instructor Office Hours

|  |  |
| --- | --- |
| Day | Time |
| MWF | 11:30 – 12:30 PM |
| Thursday | 2:00 – 4:00 PM (ZOOM) |

**Dr. Brandon Mitchell**

Office: SECC - 357

Email: Bmitchell@wcupa.edu

Please sign up for office hours at my

**Prerequisites.**

Satisfactory completion of MAT 162 (Calculus II), as well as PHY140 (General Physics II) or PHY180 (Physics II), is required to enroll in this course. I strongly recommend that students who have not yet completed MAT 261 (Calculus III) take this course concurrently.

**Required Textbook.**

The course textbook is Classical Mechanics, by John R. Taylor (University Science Books, 2005. ISBN: 9781891389221). You are expected to have **access** to this text.

**Course Web Page.**

The course is housed on D2L. The main page contains the schedule along with all homework assignments, notes and keys .

**Content.**

Mechanics is an intermediate course in classical mechanics intended for physics and engineering majors. Physics topics include Newton’s laws, energy, momentum, oscillations, Lagrangian mechanics, and central forces. Math topics include ordinary linear differential equations, complex exponentials, curvilinear coordinates, vector calculus, and variational methods.

**Time Commitment.**

PHY300 is a 3-credit hour course presented at the junior level. As such, this course requires about 6-9 hours of reading, assignments, and studying outside of class time each week.

**Student learning outcomes.**

This course contributes to the following program student learning outcomes:

• Knowledge and understanding of the concepts and principles of physics (Outcome A). Upon successful completion this course, students will demonstrate competence solving problems involving the topics listed in the Course description. Course material is introduced through lecture and textbook reading. Weekly homework assignments provide students with training and practice. Student competence is primarily assessed through in-class exams and the final exam.

• Effective Communication (Outcome C). Upon successful completion of this course, students will demonstrate the ability to formulate complete written solutions to classical mechanics problems.

**Guidelines for Office Hours.**

You set the agenda for office hours. Come with questions about the lecture, reading, homework, exams, grading, or anything else of concern or interest. Note: You must demonstrate some effort/thought process towards an answer on homework problems before coming to see me. "I have no idea where to begin" is not an acceptable opening statement.

**Grading.**

Elements of the course will contribute to the course grade as follows:

|  |  |
| --- | --- |
| **Assessment** | **% of Final Grade** |
| Homework (x12) | 24 (highest 12) |
| Exams (x4) | 51 (highest 3) |
| Final Exam | 25 |

**24% Homework:** Weekly homework assignments are posted on the course D2L site. The twelve highest assignment scores will each contribute 2% of your course grade. Homework is to be submitted under my door before 10 PM on Friday. Homework should be prepared following the Homework guidelines below. Homework is assessed for both completeness and accuracy. Homework may be “spot checked”, i.e., not all aspects of an assignment may be examined. Solutions to homework problems are posted on D2L after the assignment deadline.

**51% Exams:** There will be four in-class exams offered during the semester. The three highest exam scores will each contribute 17% of your course grade. Exams are offered on the dates listed on the Course schedule. Exams are “closed book”: the only aids allowed are a stand-alone calculator and an equation sheet. Exam scores may be scaled (“curved”) to conform to a standard distribution of grades. Failure to take a exam results in a 0 score.

**25% Final exam:** The final exam time and date are arranged the by the Registrar’s Office and can change. You should plan to be available the entire Final Exam Period (December 14-18, 2021). The final exam is “closed book” in the same manner as exams. Final exam scores may be scaled (“curved”) to conform to a standard distribution of grades. Failure to take the exam results in a 0 score.

Although unlikely, I reserve the right to alter the assessment scheme in order to accommodate for unforeseen circumstances or to better serve the learning objectives of the course. Due dates of homework, as well as the dates of exams, may change.

A letter grade will be assigned based on performance in the course according to the following scale:

|  |  |  |  |
| --- | --- | --- | --- |
| **Grade** | **Quality Points** | **Percentage Equivalents** | **Interpretation** |
| A | 4.00 | 93-100 | Excellent |
| A- | 3.67 | 90-92 |  |
| B+ | 3.33 | 87-89 | Superior |
| B | 3.00 | 83-86 |  |
| B- | 2.67 | 80-82 |  |
| C+ | 2.33 | 77-79 | Average |
| C | 2.00 | 73-76 |  |
| C- | 1.67 | 70-72 |  |
| D+ | 1.33 | 67-69 | Below Average |
| D | 1.00 | 63-66 |  |
| D- | 0.67 | 60-62 |  |
| F | 0 | < 60% | Failure |

For questions regarding Academic Dishonesty, the No-Grade Policy, Sexual Harassment, or the Student Code of Conduct, students are encouraged to refer to their major department’s handbook, the Undergraduate/Graduate Course Catalog, the Ram’s Eye View, or the University Web Site. Straight percentages will be given for all work, with the mid-semester and final grade based on overall class performance. Other considerations will influence your final grade including, class participation, class and laboratory attendance, and seeking timely guidance during office hours. Please understand that improper conduct in any of these areas will not be tolerated and may result in immediate ejection from the class. Any student achieving at a level of 'C-' or below will be given an estimated grade on their mid-term deficiency grade report.

**Homework guidelines.**

When completing homework, your goal is to formulate complete solutions to the problems. A complete solution to a problem should guide the reader through the process of understanding the problem, solving the problem, and verifying the answer. A solution is not simply “the answer”, nor is it your original scratch work. It includes all necessary figures, assumptions, explanations, mathematical steps, and checks. When writing up your homework solutions, follow these guidelines:

• Format: You will submit your **stapled** work under my office door. Your solutions should be handwritten with black or blue writing on clean, white, letter-size paper. Colored pens and graph paper are okay for drawing figures. If you make a mistake, simply cross it out – no white out or scribbling. Alternatively, you may use a tablet computer. No typesetting (i.e., do not use an equation editor or LaTeX).

• Organization: Solutions should be labeled by problem number and should be in order.

• Expository text: Include sufficient detail to guide the reader (a.k.a., someone like you) through your solution.

• Methodology: Your strategy for solving the problem should be clear to the reader. Include pictures and diagrams. List any assumptions that are not stated in the problem. When appropriate, explain why you believe your results to be accurate.

• Math: Include all necessary math steps.

• Cite references: List any collaborators, and cite any references you use, aside from the course documents.

Following these guidelines may seem daunting at first, but you get the hang of it quickly. Not all problems require a lengthy exposition. Use your judgment. Homework solutions posted on D2L provide examples of how to write solutions.

Syllabus

**Late or missed work.**

If you suspect that you will not be able to meet a course deadline you should notify me in advance so that we can discuss possible resolutions. The default policies on late and missed work are as follows:

• Other courses: No other course has priority over this course. The obligations of your other courses do not excuse you from meeting obligations for this course.

• Homework: Late work may receive a reduced score, and may not be considered. No work is accepted after solutions are posted on D2L.

• Exams: Exams are not offered at alternate times unless an exam conflicts with an event that is recognized by the WCU Excused Absences Policy– see Excused absences. Failure to take an exam results in a 0 score.

• Final exam: This course follows the WCU Final Exam Policy. The time and date of the final exam are set by the Registrar and can change. The final exam is not offered at alternate times. There is no final exam “exemption.”

**Electronic devices.**

The only personal electronic devices that may be used in class are tablet-style computers that use a stylus. Other electronic devices such as mobile phones, smart watches, iPods, and laptop computers are not conducive to the kind of note-taking necessary for this course. Their use distracts the user and students around them.

**Attendance.**

Attendance is not a graded item in this course. If you miss class, then it is your responsibility to make up the missed learning opportunity by reviewing course materials on your own. Missing class does not excuse you from completing other aspects of the course on time.

**24-hour Rule of Communication.**

The best way to contact me is via e-mail. But, be aware that I will only read and respond to e-mails written in proper English, with correct grammar, spelling, and etiquette. Do not send me any e-mails addressed to "hey" or "yo," like you would text a buddy or close friend. I have a **24-hour email policy**. All student emails will be responded to within 24 hours. Time-sensitive emails regarding e.g., extensions or illnesses will be prioritized. Just because I don’t respond within an hour or two does not mean I didn’t get your email. Please DO NOT send the same email multiple times.

**Statements Common to All WCU Undergraduate Syllabi**

**ELECTRONIC MAIL POLICY:** It is expected that faculty, staff, and students activate and maintain regular access to University-provided e-mail accounts. Official university communications, including those from your instructor, will be sent through your university e-mail account. You are responsible for accessing that mail to be sure to obtain official University communications. Failure to access will not exempt individuals from the responsibilities associated with this course.

**ACADEMIC & PERSONAL INTEGRITY:** It is the responsibility of each student to adhere to the University's standards for academic integrity. Violations of academic integrity include any act that violates the rights of another student in academic work, that involves misrepresentation of your own work, or that disrupts the instruction of the course. Other violations include (but are not limited to): cheating on assignments or examinations; plagiarizing, which means copying any part of another's work and/or using ideas of another and presenting them as one's own without giving proper credit to the source; selling, purchasing, or exchanging of term papers; falsifying of information; and using your own work from one class to fulfill the assignment for another class without significant modification. Proof of academic misconduct can result in the automatic failure and removal from this course. For questions regarding Academic Integrity, the No-Grade Policy, Sexual Harassment, or the Student Code of Conduct, students are encouraged to refer to the Department Undergraduate Handbook, the Undergraduate Catalog, the *Ram's Eye View*, and the University website at [www.wcupa.edu](http://www.wcupa.edu). You will be required to use your D2L log-in and password to access course information.

**STUDENTS WITH DISABILITIES:** If you have a disability that requires accommodations under the Americans with Disabilities Act (ADA), please present your letter of accommodations and meet with me as soon as possible so that I can support your success in an informed manner. Accommodations cannot be granted retroactively. If you would like to know more about West Chester University's Services for Students with Disabilities (OSSD), please visit them at 223 Lawrence Center. The OSSD hours of Operation are Monday – Friday, 8:30 AM – 4:30 PM. Their phone number is 610-436-2564, their fax number is 610-436-2600, their e-mail address is ossd@wcupa.edu, and their website is at [www.wcupa.edu/ussss/ossd](http://www.wcupa.edu/ussss/ossd).

**INCLUSIVE LEARNING ENVIRONMENT & ANTI-RACIST STATEMENT**: Diversity, equity, and inclusion are central to West Chester University’s mission as reflected in our Mission Statement, Values Statement, Vision Statement and Strategic Plan: Pathways to Student Success. We disavow racism and all actions that silence, threaten, or degrade historically marginalized groups in the U.S. We acknowledge that all members of this learning community may experience harm stemming from forms of oppression including but not limited to classism, ableism, heterosexism, sexism, Islamophobia, anti-Semitism, and xenophobia, and recognize that these forms of oppression are compounded by racism.

Our core commitment as an institution of higher education shapes our expectation for behavior within this learning community, which represents diverse individual beliefs, backgrounds, and experiences. Courteous and respectful behavior, interactions, and responses are expected from all members of the University. We must work together to make this a safe and productive learning environment for everyone. Part of this work is recognizing how race and other aspects of who we are shape our beliefs and our experiences as individuals. It is not enough to condemn acts of racism. For real, sustainable change, we must stand together as a diverse coalition against racism and oppression of any form, anywhere, at any time.

Resources for education and action are available through WCU’s Office for Diversity, Equity, and Inclusion (ODEI), DEI committees within departments or colleges, the student ombudsperson, and centers on campus committed to doing this work (e.g., Dowdy Multicultural Center, Center for Women and Gender Equity, and the Center for Trans and Queer Advocacy).

Guidance on how to report incidents of discrimination and harassment is available at the University’s Office of Diversity, Equity and Inclusion.

**EXCUSED ABSENCES POLICY FOR UNIVERSITY-SANCTIONED EVENTS:** Students are advised to carefully read and comply with the excused absences policy for university-sanctioned events contained in the WCU Undergraduate Catalog. In particular, please note that the "responsibility for meeting academic requirements rests with the student," that this policy does not excuse students from completing required academic work, and that professors can require a "fair alternative" to attendance on those days that students must be absent from class in order to participate in a University-Sanctioned Event.

**REPORTING INCIDENTS OF SEXUAL VIOLENCE:** West Chester University and its faculty are committed to assuring a safe and productive educational environment for all students. In order to meet this commitment and to comply with Title IX of the Education Amendments of 1972 and guidance from the Office for Civil Rights, the University requires faculty members to report incidents of sexual violence shared by students to the University's Title IX Coordinator, Ms. Lynn Klingensmith. The only exceptions to the faculty member's reporting obligation are when incidents of sexual violence are communicated by a student during a classroom discussion, in a writing assignment for a class, or as part of a University-approved research project. Faculty members are obligated to report sexual violence or any other abuse of a student who was, or is, a child (a person under 18 years of age) when the abuse allegedly occurred to the person designated in the University protection of minors policy.  Information regarding the reporting of sexual violence and the resources that are available to victims of sexual violence is set forth at the webpage for the Office of Social Equity at <http://www.wcupa.edu/_admin/social.equity/>.

**EMERGENCY PREPAREDNESS:** All students are encouraged to sign up for the University's free WCU ALERT service, which delivers official WCU emergency text messages directly to your cell phone. For more information, visit www.wcupa.edu/wcualert. To report an emergency, call the Department of Public Safety at 610-436-3311.

**COVID-19 STATEMENT:** Part of West Chester University's response to the COVID-19 pandemic was to switch the vast majority of instruction to remote. This decision was made out of an abundance of caution to protect the health of all members of the WCU community. Faculty have been asked to make every effort to adapt their courses to this novel situation while still meeting the critical learning outcomes of the course. Students are asked to discuss any problems with the new course format and schedule directly with their instructors. Patience and flexibility on everyone's behalf are critical to our community's navigation of this public health crisis.

**Tentative Schedule**

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| --- | --- | --- | --- | --- |
| **WEEK** | **Date** | **Topic** | **Reading** | **HW** |
| **1** | **8-29** | Introduction; dimensional analysis | Taylor 1.1 | **N/A** |
| **8-31** | Taylor’s Theorem |  |
| **9-2** | Limits & Approximations |  |
| **2** | **9-5** | **Labor Day** | **1** |
| **9-7** | Newton’s laws | Taylor 1.3 - 1.6 |
| **9-9** | Separation of Variables |  |
| **3** | **9-12** | Time- & position-dependent forces |  | **2** |
| **9-14** | Velocity-dependent forces | Taylor 2.1 |
| **9-16** | Linear drag | Taylor 2.2-2.4 |
| **4** | **9-19** | Energy in one dimension | Taylor 4.6, 4.7 | **3** |
| **9-21** | Conservative motion | Taylor 4.6, 4.7 |
| **9-23** | Small oscillations & SHM | Taylor 5.1, 5.2 |
| **5** | **9-26** | **EXAM 1: Solving Newton’s laws** | **4** |
| **9-28** | Complex exponentials | Taylor 2.6 |
| **9-30** | Complex exponential ansatz | Taylor 5.1, 5.2 |
| **6** | **10-3** | Damped oscillations | Taylor 5.4 | **5** |
| **10-5** | Driven oscillations | Taylor 5.5 |
| **10-7** | Transients, attractors, resonance | Taylor 5.6 |
| **7** | **10-10** | Vectors | Taylor 1.2 | **6** |
| **10-12** | Polar coordinates | Taylor 1.7 |
| **10-14** | Work, line integrals | Taylor 4.1 |
| **8** | **10-17** | **Fall Break** | **7** |
| **10-19** | **EXAM 2: 1D Energy & oscillations** |
| **10-21** | Potential energy | Taylor 4.2 |
| **9** | **10-24** | Conservative forces are gradients | Taylor 4.3 | **8** |
| **10-26** | Non-conservative forces and curl | Taylor 4.4 |
| **10-28** | Momentum | Taylor 1.7, 3.1, 3.2, |
| **10** | **10-31** | Functionals | Taylor 6.1 | **9** |
| **11-2** | Extremizing functionals | Taylor 6.1 |
| **11-4** | The Euler-Lagrange equations | Taylor 6.2 |
| **11** | **11-7** | **EXAM 3: Energy in 3D** | **10** |
| **11-9** | Applications | Taylor 6.3, 6.4 |
| **11-11** | Hamilton’s Principle | Taylor 7.1 |
| **12** | **11-14** | Constrained systems | Taylor 7.2-7.4 | **11** |
| **11-16** | Cyclic coordinates | Taylor 7.6 |
| **11-18** | Noether's theorem | Taylor 7.6 |
| **13** | **11-21** | Applications | Taylor 7.5 | **N/A** |
| **11-23** | **Thanksgiving Break** |
| **11-25** |
| **14** | **11-28** | Nonlinear is different | Taylor 12.1 | **12** |
| **11-30** | Expected features of the DDP | Taylor 12.2, 12.3 |
| **12-2** | Period doubling | Taylor 12.4 |
| **15** | **12-5** | **EXAM 4: Lagrangian mechanics** | **13** |
| **12-7** | Universality; bifurcation diagrams | Taylor 12.4, 12.6 |
| **12-9** | Sensitivity to initial conditions | Taylor 12.5 |
|  | **12-12** | Review for final exam | **N/A** |
| **Finals Week** |  |