Point Loma Nazarene University

PHY 341-01: Analytical Mechanics 4 Credits Course Syllabus, Fall 2017

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Class Meeting Time and Place: RS 219: 1:30- 2:35 MWF
(1st Day of class 8/29/2017 – Monday schedule)

PLNU forward

PLNU Mission

To Teach ~ To Shape ~ To Send 

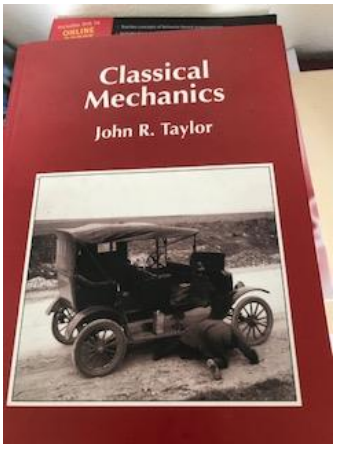
University Mission:
Point Loma Nazarene University exists to provide higher education in a vital Christian community where minds are engaged and challenged, character is modeled and formed, and service becomes an expression of faith. Being of Wesleyan heritage, we aspire to be a learning community where grace is foundational, truth is pursued, and holiness is a way of life.

Department Mission: The Physics and Engineering Department at PLNU provides strong programs of study in the fields of Physics and Engineering. Our students are well prepared for graduate studies and careers in scientific and engineering fields. We emphasize a collaborative learning environment which allows students to thrive academically, build personal confidence, and develop interpersonal skills. We provide a Christian environment for students to learn values and judgment, and pursue integration of modern scientific knowledge and Christian faith.

COURSE DESCRIPTION
This course contains Newtonian mechanics, dynamics of particles and rigid bodies, oscillatory motion, central forces, inertial tensors, Lagrangian and Hamiltonian formulations. **Prerequisite(s):** PHY 242 (Univ. Physics) and MTH 274 (Calculus III). **Recommended:** MTH 333 (Differential Equations).
The goal of this course is to understand Classical Mechanics at an intermediate level. Mechanics is the study of how things move from subatomic particles, to cars and rockets, through the rotation of galaxies and beyond. We will begin with Newton's approach you learned in University physics, apply it to more complicated problems, and continue on with more powerful and advanced techniques such as the Lagrangian approach which can allow one to solve much more complex motion problems with comparative ease.

Disclaimer: The content of this syllabus and/or course outline may change during this semester.

Materials:
Text book: *Classical Mechanics* by Taylor, 1st edition. Published by University Science Books 2005. Access to MATLAB (or similar program). Graphing Calculator.



COURSE LEARNING OUTCOMES
This course supports the overall learning objectives of the physics and engineering programs: To develop an understanding of the fundamental principles of physics and apply physical principles, mathematical reasoning, and computational techniques to solve real-world problems.
Within these broader outcomes, in this course you will:
1. Translate a physical description of a classical mechanics problem to a math equation necessary to solve it.
2. Explain the physical meaning of the mathematical formulation.
3. Articulate the big ideas from each section.
4. Sketch the physical parameters (the situation and coordinates) of a problem.
5. Justify and explain your thinking and approach to a problem or physical situation in written or oral form.
6. When appropriate for a given problem you should be able to predict your expectations of a problem (such as direction of a force, dependence on coordinate variables, or behavior at large distances or times) and in all cases evaluate the reasonableness of a solution.
7. Apply computational techniques to help in solving mechanics problems
8. Correctly apply problem solving techniques such as approximations and series expansions.

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Class Enrollment: It is the student's responsibility to maintain his/her class schedule. Should the need arise to drop this course (personal emergencies, poor performance, etc.), the student has the responsibility to follow through (provided the drop date meets the stated calendar deadline established by the university), not the instructor. Simply ceasing to attend this course or failing to follow through to arrange for a change of registration (drop/add) may easily result in a grade of F on the official transcript.

Class Meetings: Learning analytical mechanics requires active learning and participation during class. In preparation for each class meeting there is a reading assignment. To maximize your learning and participation during our meetings it is very important that you have read this material before class.

Technology, devices and classroom participation policy: For my lecture classes, use of computers such as notebooks, iPads, and similar devices shall be used just for class activities, PowerPoint, etc. Use of extra-curricular apps on smartphones such as texting and social media needs to be closed such that it does not disrupt or distract the classroom environment, classmates or the instructor. Please be professional and courteous in this area of your use of technology in the classroom.

Credit Hour: In the interest of providing sufficient time to accomplish the stated course learning outcomes, this class meets the PLNU credit hour policy for a 4 unit class delivered over 16 weeks. Specific details about how the class meets the credit hour requirements can be provided upon request.

CANVAS and COURSEWORK:
The online resource Canvas is integral for this course, and you are expected to login regularly. You need a reliable internet connection to be able to use this resource.

Attendance and participation Policy: Attendance is expected at each class session. In the event of an absence you are responsible for the material covered in class and the assignments given that day. Regular and punctual attendance at all classes is considered essential to optimum academic achievement. If the student is absent from more than 10 percent of class meetings, the faculty member can file a written report which may result in disenrollment. If the absences exceed 20 percent, the student may be de-enrolled without notice until the university drop date or, after that date, receive the appropriate grade for their work and participation.
See http://catalog.pointloma.edu/content.php?catoid=24&navoid=1581#Class_Attendance in the Undergraduate Academic Catalog.

ASSESSMENT AND GRADING
Homework Policy:
Homework problems in this course are of key importance for the student to learn the necessary applications of science to mathematical formulations.

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Homework Policy (continued):

Problems in homework allow the opportunity of building skills in complex physical and mathematical problem solving. They will require considerable time and personal effort this term. Remember that it is not the solution that itself that is the true goal; it is the process to the solution that will develop your skill as a physicist or engineer.

Submission format:

Work the problem in clear logical steps. Solutions should be clear enough one of your peers could follow your steps if they had not worked the problem before. In particular you should (1) carefully draw figures, (2) define variables, (3) have a box drawn around your final answer, (4) include units, and (5) if applicable a statement of the solution if it is reasonable, or if not, why (6) submit answers written in pencil in neat, legible work.

Collaboration:

I expect and encourage collaboration between you and your peers while working on your homework. (Most good ideas come out of discussions with colleagues. This skill is highly valued by employers, and virtually all science and engineering takes place within groups or teams.) That being said, your work should be your *own original solution*.

Allow adequate time to work and think about problems by yourself first before you work together with your peers or ask questions of me. The guideline is that you should have no trouble explaining or repeating work that you turn in.

Late Work: I generally do not accept late work unless there is a documented emergency. If late work is submitted, the following applies in **late submission:** Up to one late assignment per quad will be accepted late with a 10% reduction in grade for every day it is late. This begins with a 10% reduction for an assignment turned in later in the day after this homework has been collected at the beginning of class.

Exams: Three exams will be given during the semester, and the final exam is at 7:30 on Friday of finals week.

Project: We will be creating projects that use the principles of mechanics. The goal is that you will produce a journal-type article describing the situation you analyze, the methods you use, and some basic conclusions. We will have several check-in points during the semester to help you plan out your work on this project. More details will be given in class.

Preclass questions: Each class day there will be three Preclass questions to answer electronically. These will be due by midnight the day of class. Your responses to Preclass questions are graded on the following scale: 2=demonstrates reading/thinking; 1=room for improvement, 0=unsatisfactory.

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Policy for missed exams: Unless you have express written permission from me long before the date of the exam to take the exam on another day, there will be no makeup exams for this course.

Final Grade: The grade you earn in this course is based on the scale shown below. The points you receive during the course are weighted accordingly:

A	100 - 91.0
A-	91.0 - 89.5
B+	89.5 - 87.0
B	87.0 - 81.0
B-	81.0 - 79.5
C+	79.5 - 77.0
C	77.0 - 71.0
C-	71.0 - 69.5
D+	69.5 - 67.0
D	67.0 - 61.0
D-	61.0 - 55.0

- Homework: 25%
- Tests (3): 30%
- Preclass & Class Summaries: 10% (Including collaborative exercises)
- Project: 15%
- Final Exam: 25%.

Christian Practices in the Science Classroom:
This is my plan for the fall to be used in the classroom of PHYS 341. My idea is one to encourage kindness and mutual concern for one another by implementing a collaborative learning exercise using example problem assignments from class and have the each student self-assess his talent or ability to help other students. "So in everything, do to others what you would have them do to you, for this sums up the Law and the Prophets". Matthew 7:12. The plan is to set the last 10-12 minutes of each lecture to be set aside for this exercise, allowing the students to assist one another. More detail will be discussed for this exercise in the class lecture.

PLNU ACADEMIC HONESTY POLICY
Students should demonstrate academic honesty by doing original work and by giving appropriate credit to the ideas of others. Academic dishonesty is the act of presenting information, ideas, and/or concepts as one's own when in reality they are the results of another person's creativity and effort. A faculty member who believes a situation involving academic dishonesty has been detected may assign a failing grade for that assignment or examination, or, depending on the seriousness of the offense, for the course. Faculty should follow and students may appeal using the procedure in the university Catalog. See http://catalog.pointloma.edu/content.php?catoid=24&navoid=1581#Academic_Honesty for definitions of kinds of academic dishonesty and for further policy information.

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PLNU ACADEMIC ACCOMMODATIONS POLICY

If you have a diagnosed disability, please contact PLNU's Disability Resource Center (DRC) within the first two weeks of class to demonstrate need and to register for accommodation by phone at 619-849-2486 or by e-mail at DRC@pointloma.edu. See Disability Resource Center for additional information. For more details see the PLNU catalog: http://catalog.pointloma.edu/content.php?catoid=24&navoid=1581#Academic_Accommodations Students with learning disabilities who may need accommodations should discuss options with the instructor during the first two weeks of class.

FINAL EXAMINATION POLICY

Successful completion of this class requires taking the final examination **on its scheduled day**. The final examination schedule is posted on the Class Schedules site. No requests for early examinations or alternative days will be approved.

The final exam date and time is set by the university at the beginning of the semester and may not be changed by the instructor. The day is **December 11, 2017, Monday, from 1:30 – 4:00 pm**. This schedule can be found on the university website and in the course calendar. No requests for early examinations will be approved. Only in the case that a student is required to take three examinations in the same day of finals week, is an instructor authorized to consider changing the exam date and time for that particular student.

PLNU COPYRIGHT/PROTECTED MATERIALS POLICY

Point Loma Nazarene University, as a non-profit educational institution, is entitled by law to use materials protected by the US Copyright Act for classroom education. Any use of those materials outside the class may violate the law.

FERPA POLICY

In compliance with federal law, neither PLNU student ID nor social security number should be used in publicly posted grades or returned sets of assignments without student written permission. This class will meet the federal requirements by (Note: each faculty member should choose one strategy to use: distributing all grades and papers individually; requesting and filing written student permission; or assigning each student a unique class ID number not identifiable on the alphabetic roster.). Also in compliance with FERPA, you will be the only person given information about your progress in this class unless you have designated others to receive it in the "Information Release" section of the student portal. See Policy Statements in the (undergrad/ graduate as appropriate) academic catalog.

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Course Schedule

Date	Lecture		Topic	Reading
8/29	1	T Aug 29	Introductions	none
8/30	2	W Aug 30	Introduction to Newtonian Mechanics	1.1-1.3
9/1	3	F Sept 1	1-D projectiles	1.4-1.5
9/4		M Sept 3	No class meeting Labor Day	
9/6	4	W Sept 5	2-D Projectiles	1.6-1.7
9/8	5	F Sept 7	Atwood and B field	2.5-2.7
9/11	6	M Sept 11	Linear and Angular Momentum	3.1,3.3
9/13	7	W Sept 13	Momentum: Rockets	3.2
9/15	8	F Sept 15	Energy (T4.1-2)	4.1-4.2
9/18	9	M Sept 18	Energy(T4.3-5)	4.3-4.4
9/20	10	W Sept 20	Energy(T4.6-4.7)	4.6-4.7
9/22	11	F Sept 22	Energy	4.8-4.10
9/25	12	M Sept 25	Exam #1	
9/27	13	W Sept 27	Oscillations 1	5.1-5.2
9/29	14	F Sept 29	Oscillations 2	5.3-5.4
10/2	15	M Oct 26	Oscillations 3	5.5-5.6
10/4	16	W Oct 4	Oscillations 4	5.7-5.9
10/6	17	F Oct 6	Calc of Variations 1	6.1-6.4
10/9	18	M Oct 9	Lagrange	7.1-7.2
10/11	19	W Oct 11	Lagrange	7.2-7.3
10/13	20	F Oct 13	Lagrange	7.4-7.5
10/16	21	M Oct 16	Lagrange	7.6-7.7
10/18	22	W Oct 18	Lagrange	7.8-7.9
10/20		F Oct 20	Fall Break	
10/23	23	M Oct 23	Lagrange	7.9-7.10
10/25	24	W Oct 25	Exam #2	
10/27	25	F Oct 27	Two-Body Central Force	8.1-8.4
10/30	26	M Oct 30	Two-Body Central Force	8.5-8.6
11/1	27	W Nov 1	Two-Body Central Force	8.7
11/3	28	F Nov 3	Two-Body Central Force	8.8
11/6	29	M Nov 6	Mechanics in Non-inertial Ref Frames	9.1-9.3
11/8	30	W Nov 8	Mechanics in Non-inertial Ref Frames	9.4-9.6
11/10	31	F Nov 10	Mechanics in Non-inertial Ref Frames	9.7-9.8
11/13	32	M Nov 13	Mechanics in Non-inertial Ref Frames	9.9-9.10
11/15	33	W Nov 15	Gravity (Potential) Thorton/Marion txt	5.1-5.2
11/17	34	F Nov 17	Gravity (Potential) Thorton/Marion txt	5.2-5.4
11/20	35	M Nov 20	Gravity (Potential) Thorton/Marion txt	5.5
11/22		W Nov 22	Thanksgiving Break	
11/24		F Nov 24	Thanksgiving Break	
11/27	36	M Nov 27	Wrap-up Review	10.1-10.2
11/29	37	W Nov 29	Exam #3	10.3

12/1	38	F Dec 1	Coriolis Forces	9.7
12/4	39	M Dec 4	Motion relative to Earth Thorton/Marion txt	10.4
12/6	40	W Dec 6	Dynamic of rigid bodies	10.3-10.4
12/8	41	F Dec 8	Dynamic of rigid bodies	10.5-10.6
12/11	42	M Dec 11	Final Exam 7:30 am	