Department of Physics and Engineering, Point Loma Nazarene University
EGR/PHY 3043 – Analytical Mechanics – 3 Units – Fall 2019

Lecture: MWF 7:25 – 8:20 am, RS 365
Final Exam: 7:30 – 10:00 am, Friday December 20, 2019.

Professor: Dr. Michelle Chen **E-mail:** MichelleChen@pointloma.edu
Office: Rohr Science 264 **Office Phone:** 619-849-2960
Office Hours: M 10:30 am – 12:00 pm; T 10:45 am – 11:45 am; 1:30 pm – 2:30 pm;
W 10:45 am – 11:15 am; R 12:00 am – 12:30 pm;
F 10:45 am – 11:15 am; and by appointment

Textbook: *Classical Mechanics*, by John Taylor, University Science Books 2005.
Supplemental Textbook: *Vector Mechanics for Engineers – Dynamics*, 11th Edition, by Beer, Johnston, Mazurek, Cornwell, and Self, McGraw Hill 2016.

Course Description: Newtonian mechanics, dynamics of particles and rigid bodies, oscillatory motion, central forces, inertial tensors, Lagrangian and Hamiltonian formulations.

Learning Outcomes: This course supports the overall learning objectives of the physics and engineering programs in building your ability: (1) to apply physical principles, mathematical reasoning, and computational techniques to solve real-world problems (LO2), (2) to demonstrate good ethics in science (LO4), and (3) to effectively communicate complicated technical information (LO5).

Reading *is an essential part of PHY/EGR 3043!* Reading *before* class is very important. Lecture is to clarify your understanding, to help you make sense of the material. I will assume you have done the required readings in advance! Taylor is an excellent text - it *will* make a huge difference if you spend the time and effort to carefully read and follow the text.

Pre-Class: In preparation for each class meeting there is a reading assignment, which is very important to help you come prepared to class. After completing the reading assignment, you will answer a few questions and submit them electronically through Canvas by 7:00 am before class. These submissions will be graded on the following scale: 2 = demonstrates reading, 1 = room for improvement, 0 = unsatisfactory. Late submissions will result in a 0.5 point deduction. These points are accumulated and are worth 10% of the final grade. This electronic communication is very important because it is your voice in what material we emphasize during class meetings and provides me constant feedback of your understanding of the material.

Homework: is due almost every week at the *start* of class. Late homework will not be accepted, and your lowest score will be dropped. Homework is <u>crucial</u> for developing an understanding of course material, not to mention building skills in physical and mathematical problem solving. They will require considerable time and personal effort!

Collaboration is strongly encouraged, as it is an essential skill in science and engineering (and highly valued by employers!) Social interactions are critical to scientists' success - most good ideas grow out of discussions with colleagues; essentially all scientists work as part of a group. Find partners and work together. However, it is also important that you OWN the material. Limit yourself to verbal help; try not to take written information from others (don't take written notes when you talk to others) This will ensure that you think things through independently after you get help. If you do well on homework and poorly on exams, you are probably getting too much help. No credit will be given for a correct answer, unless accompanied by a complete and correct derivation. The point is not to just find the answer, but to find out how to *construct* the answer. There will be time for peer discussion during classes: try to help your partners get over confusions, listen to them, ask each other questions, critique, *teach each other.* You will learn a lot this way!

Note: *While collaboration is the rule in technical work, evaluations of individuals also play an important role. Exams will be done without help from others. For* all assignments, *the work you turn in must in the end be* your own*: in your own words, reflecting your own understanding.* (If you ever feel disadvantaged or isolated, please contact me! I can discretely try to help arrange study groups).

Exams: There are three in-class, closed-book exams, and no makeups. *You may not miss any exam* except for reasons beyond your control, approved by Dr. Chen (usually a medical crisis with written documentation.) You may bring one side of a single sheet of 8.5 in. x 11 in. paper for each exam, with your own *handwritten* notes. Calculators with scientific notation are allowed, but ***NO*** cell phones. There will be a comprehensive final research project presentation during final exam week.

Grading: Your course grade is largely determined by a combination of your performance on exams and homework.

Pre-Class	10 %
Homework	25 %
Exams	50 %
Final Research Project	15 %

The grade you earn in this course is based on the following scale:

A	A-	B+	B	B-	C+	C	C-	D+	D	D-
S≥ 91.0	91.0 >S≥ 89.5	89.5 >S≥ 87.5	87.5 >S≥ 81.0	81.0 >S≥ 79.5	79.5 >S≥ 77.5	77.5 >S≥ 71.0	71.0 >S≥ 69.5	69.5 >S≥ 67.5	67.5 >S≥ 61.0	61.0 >S≥ 57.0

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 is an expression of faith. Being of Wesleyan heritage, we strive 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.

Attendance:
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 de-enrollment. 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 the Undergraduate Academic Catalog Class Attendance.

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.

Academic Accommodations:
While all students are expected to meet the minimum standards for completion of this course as established by the instructor, students with disabilities may require academic adjustments, modifications or auxiliary aids/services. At Point Loma Nazarene University (PLNU), these students are requested to register with the Disability Resource Center (DRC), located in the Bond Academic Center. (DRC@pointloma.edu or 619-849-2486). The DRC's policies and procedures for assisting such students in the development of an appropriate academic adjustment plan (AP) allows PLNU to comply with Section 504 of the Rehabilitation Act and the Americans with Disabilities Act. Section 504 (a) prohibits discrimination against students with special needs and guarantees all qualified students equal access to and benefits of PLNU programs and activities. After the student files the required documentation, the DRC, in conjunction with the student, will develop an AP to meet that student's specific learning needs. The DRC will thereafter

email the student's AP to all faculty who teach courses in which the student is enrolled each semester. The AP must be implemented in all such courses.

If students do not wish to avail themselves of some or all of the elements of their AP in a particular course, it is the responsibility of those students to notify their professor in that course. PLNU highly recommends that DRC students speak with their professors during the first two weeks of each semester about the applicability of their AP in that particular course and/or if they do not desire to take advantage of some or all of the elements of their AP in that course.

Academic Honesty:
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 Academic Honesty for definitions of kinds of academic dishonesty and for further policy information.

Final Exam: 7:30 – 10:00 am, Friday December 20, 2019.
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. 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 exams during the same day of finals week, is an instructor authorized to consider changing the exam date and time for that particular student.

Copyright Protected Materials:
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.

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 3-unit class delivered over 15 weeks. Specific details about how the class meets the credit hour requirements can be provided upon request.

EGR/PHY 3043: Analytical Mechanics (Fall 2019)

(Tentative Syllabus, Subject to Updates)

Date	Topic	Reading	Homework
W 09/04/19	Introduction	Introduction, Chapter 1	
F 09/06/19	Newton's Law of Motion	Chapter 1	
M 09/09/19	Projectiles and Charge Particles	Chapter 2	
W 09/11/19	Projectiles and Charge Particles	Chapter 2	HW1
F 09/13/19	Projectiles and Charge Particles	Chapter 2	
M 09/16/19	Momentum and Angular Momentum	Chapter 3	
W 09/18/19	Momentum and Angular Momentum	Chapter 3	HW2
F 09/20/19	Momentum and Angular Momentum	Chapter 3	
M 09/23/19	Energy	Chapter 4	
W 09/25/19	Energy	Chapter 4	HW3
F 09/27/19	Energy	Chapter 4	
M 09/30/19	Catchup		
W 10/02/19	**Test 1**		HW4
F 10/04/19	Oscillations	Chapter 5	
M 10/07/19	Oscillations	Chapter 5	
W 10/09/19	Oscillations	Chapter 5	HW5
F 10/11/19	Oscillations	Chapter 5	
M 10/14/19	Oscillations	Chapter 5	
W 10/16/19	Oscillations	Chapter 5	HW6
F 10/18/19	Calculus of Variations	Chapter 6	
M 10/21/19	Lagrange's Equations	Chapter 7	
W 10/23/19	Lagrange's Equations	Chapter 7	HW7
F 10/25/19	***No Class: Fall Break***		
M 10/28/19	Lagrange's Equations	Chapter 7	
W 10/30/19	Catchup		HW8
F 11/01/19	**Test 2**		

M 11/04/19	Two-Body Central-Force Problems	Chapter 8	
W 11/06/19	Two-Body Central-Force Problems	Chapter 8	HW9
F 11/08/19	Two-Body Central-Force Problems	Chapter 8	
M 11/11/19	Two-Body Central-Force Problems	Chapter 8	
W 11/13/19	Mechanics in Noninertial Frames	Chapter 9	HW10
F 11/15/19	Mechanics in Noninertial Frames	Chapter 9	
M 11/18/19	Mechanics in Noninertial Frames	Chapter 9	
W 11/20/19	Mechanics in Noninertial Frames	Chapter 9	HW11
F 11/22/19	Rigid Body	Dynamics	
M 11/25/19	Rigid Body	Dynamics	
W 11/27/19	**No Class: Thanksgiving**		
F 11/29/19	**No Class: Thanksgiving**		
M 12/02/19	Rigid Body	Dynamics	
W 12/04/19	Rigid Body	Dynamics	HW12
F 12/06/19	Catchup		
M 12/09/19	**Test 3**		
W 12/11/19	Final Project		
F 12/13/19	Final Project		
M 12/16/19			
W 12/18/19			
F 12/20/19	**Final Exam (7:30 - 10:00 am)**		