

## Analytical Mechanics II – PHYS 400-0001 & PHYS 500-0001

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Semester: Spring 2019 (Jan 14<sup>th</sup> – May 10<sup>th</sup>)  
Class Number: 2883 (400), 3437 (500)  
Lectures: Tue & Thu, 12:30 – 13:45  
Location: La Tourette Hall 227  
Office hours: Tue & Thu, 11:00 – 12:00,  
La Tourette Hall 217  
Webpage: [http://www.aglatz.net/teaching/mechanicsII\\_S2019/](http://www.aglatz.net/teaching/mechanicsII_S2019/)

### ***Required textbook***

- S.T. Thornton and J.B. Marion, Classical Dynamics of Particles and Systems, 5<sup>th</sup> Edition (Brooks/Cole, Belmont, CA, 2004).

### ***Contents covered in this course***

- Ch. 3.1 - 3.9: Oscillations
- Ch. 4.1 –4.4, and selected topics from 4.5 –4.7: Nonlinear Oscillations
- Ch. 6.1 –6.7: Calculus of Variations
- Ch. 7.1 –7.11: Lagrangian and Hamiltonian Dynamics
- Midterm Exam
- Ch. 12.1 –12.4, 12.6 –12.9: Coupled Oscillations
- Ch. 13.1 –13.7, and selected topics from 13.8 –13.9: Continuous Systems
- Ch. 14.1 –14.11: Special Relativity
- Catch up/Review
- Final Exam

### ***Course information, policies, and advice***

- The course will be given as classroom lecture and follows selected chapters of the required textbook (see above).
- There will be several problems solved in class for every chapter we study. Additional problems will be assigned as homework. There is no substitute for solving problems on your own.
- No late submission of homework assignments or papers will be accepted and no make-up work will be offered for missed attendance or exams, unless a valid excuse is presented in official writing by an authorized party (e.g. a doctor's note supporting absence from class due to illness or a medical procedure, or the head of a unit requesting advance permission for a student to be absent on certain days). Such excuses should be submitted in advance of the absence, if possible, but no later than within a week after returning to class.
- Attendance will not be taken, but you cannot hand in homework without being in

class, and you will not do well if you do not follow the coursework. If you want to hand in homework and you are not able to attend class, it must be handed in early, not late.

- There will be a midterm and a comprehensive final exam. Exams are closed book and electronic devices are not allowed. Formula sheets will be provided as needed.
- A single handwritten page (one sided) and be brought to the exams.
- Students are strongly encouraged to seek one-on-one consultation with the instructor for any need related to the course. Phone or e-mail can be used if schedule conflicts prevent in-person meetings. The more time one spends on the course, the more fruitful those sessions will be.
- Efforts will be made to communicate all important announcements relating to the course either by e-mail or by posting on the course pages listed above. In addition to paying prompt attention to notifications, students should make it a habit to visit those pages frequently - at least once the day before each class. However, some announcements may also be made verbally during lectures, and not communicated in writing. If a student is absent during any part of a lecture, it is her responsibility to follow up with the instructor to be sure that she did not miss any announcement. Ignorance of any announcement - written or verbal - shall not count as an excuse.
- To get the maximum out of each lecture, come prepared by reading in advance the part of the textbook that is going to be covered in class that day.
- Last, but not the least, be respectful and courteous to others in the class. Use of "smart" devices -such as laptops, tablets, or smart phones - in class is strongly discouraged, unless used to take notes. In particular, they must not be used for entertainment or communication while the class is in session. Everyone needs to do his/her part to help make the atmosphere in the classroom as conducive to learning as possible.

### ***Learning outcome***

At the end of the course, a student is expected to have a basic understanding of

- the core theoretical concepts of Classical Mechanics, formally developed using variational principles, in the context of elementary mechanical systems,
- how these concepts serve as a foundation for a wide range of applications in all branches of physics and some areas of engineering,
- the connections between the theoretical framework of quantum mechanics and its roots in classical mechanics,
- the theory of special relativity.

Having completed the course, a student should be able to

- quantitatively solve problems in simple idealized mechanical systems.
- qualitatively analyze, understand and explain design motivations and operational principles of mechanical systems encountered in real life.

### ***Prerequisites:***

PHYS 300 and “B” or better in at least a junior-level calculus-based course in classical mechanics (a.k.a “analytical mechanics”). Students are also expected to be familiar with such mathematical concepts and tools as differential and integral calculus, vector algebra, vector calculus, partial differential equations, power (Taylor) series expansions, matrix properties and manipulations including eigenvalue problems.

### ***Grading***

The final grade is determined according to

- 40%: homework percentage
- 25%: midterm exam percentage
- 35%: final exam percentage

This results in a total score between 0 and 1, which is then multiplied by 12, rounded to the closed integer, divided by 3, and finally graded according to\*

<http://www.niu.edu/regrec/grading/gradingfaqs.shtml>

Note: To pass this course, you MUST score at least 50% on the homework.

\* values below 2 are round to the closed integer.

### ***Academic Integrity***

Good academic work must be based on honesty. The attempt of any student to present as his or her own work that which he or she has not produced is regarded by the faculty and administration as a serious offense. Students are considered to have cheated if they copy the work of another during an examination or turn in a paper or an assignment written, in whole or in part, by someone else. Students are guilty of plagiarism, intentional or not, if they copy material from books, magazines, or other sources without identifying and acknowledging those sources or if they paraphrase ideas from such sources without acknowledging them. Students guilty of, or assisting others in, either cheating or plagiarism on an assignment, quiz, or examination may receive a grade of F for the course involved and may be suspended or dismissed from the university.

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#### Accessibility Statement

Northern Illinois University is committed to providing an accessible educational environment in collaboration with the Disability Resource Center (DRC). Any student requiring an academic accommodation due to a disability should let his or her faculty member know as soon as possible. Students who need academic accommodations based on the impact of a disability will be encouraged to contact the DRC if they have not done so already. The DRC is located on the 4th floor of the Health Services Building, and can be reached at 815-753-1303 (V) or [drc@niu.edu](mailto:drc@niu.edu).