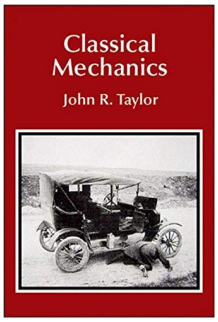
COURSE OUTLINE **Classical Mechanics I, Phys 430 001 CRN: 95205** **Fall 2024**

Instructor: **Andres Jerez**: **jerez@njit.edu**
(When writing, please include course and section in the subject: Phys 430 001)

Lecture Times: Mondays and Wednesdays, 8:30 AM – 9:50 AM, FMH 407

Office hours: Mondays, 2:30 PM – 3:30 PM, Wednesdays, 11:30 AM – 12:30 PM, TIER 455, and by appointment.



Textbook: *Classical Mechanics*, John R. Taylor, University Science Books, 2005

ISBN-10: 189138922X; ISBN-13: 978- 1891389221

CANVAS: The Learning Management System at NJIT is Canvas . Lecture notes, quizzes, grades, exams, and additional course material will be managed through Canvas.

LECTURES: It is expected that students will attend all lectures and recitations. More than 3 unexcused absences (in total) are excessive. If you have excusable absences, contact the Dean of Students. If you must withdraw from the course, do it officially through the Registrar. Do not simply stop attending and taking exams: that forces the instructor to assign a course grade of "F."

EXAMS:

Midterm Exam: There will be a midterm on Wednesday, October 23, covering chapters 1 – 6. The exam will contain five open-ended problems, each worth 10 points for the total score of 50. The exam will be administered within Canvas, including the submission. The format is open textbook but closed notes.

Final Exam: TBD A final exam will be given during the final exam period (TBA), covering chapters 7 – 11. The exam will contain five open-ended problems, each worth 10 points for the total score of 50. The exam will be administered within Canvas, including the submission. The format is open textbook but closed notes.

QUIZZES:

Starting on September 16, a lecture quiz will be given by the end of every Monday class. The quiz will contain up to 3 open-ended problems for a total score of 15 points.

HOMEWORK:

No formal homework will be assigned; however, I suggest below practice problems that a student should attempt to solve. Problems for the lecture quizzes, midterm, and final may be (but do not have to be) selected from the suggested problems.

GRADING: Your final letter grade in Phys 430 will be based on a composite score that includes the quizzes, and the exams

- **40%** for the quizzes
- **30%** for the midterm exam
- **30%** for the final exam

The cutoff percentages for various letter grades will be in the range of:
85% for A
80% for B+
70% for B
65% for C+
50% for C
40% for D
F below 40 %

HONOR CODE STATEMENT: NJIT has a zero-tolerance policy for cheating of any kind and for student behavior that disrupts learning by others. Violations will be reported to the Dean of Students. The penalties range from a minimum of failure in the course plus disciplinary probation up to expulsion from NJIT. Avoid situations where your own behavior could be misinterpreted as dishonorable. **Students are required to agree to the NJIT Honor Code on each exam, assignment, quiz, etc. for the course.**

- Statement on Academic Integrity:

  "Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the academic code of integrity policy that is found at: http://www5.njit.edu/policies/sites/policies/files/academic-integrity-code.pdf.

  Please note that it is my professional obligation and responsibility to report any academic misconduct to the Dean of Students Office. ***Any student found in violation of the code by cheating, plagiarizing or using any online software inappropriately will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university.*** *If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office at dos@njit.edu"*

- Statement on Generative AI
  - *This course expects students to work without artificial intelligence (AI) assistance in order to better develop their skills in this content area. As such, AI usage is not permitted throughout this course under any circumstance.*

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LEARNING OUTCOMES:

After completing the course, students should be able to:

- State Newton's laws and apply them to developing equations of motions in different situations
- Solve Classical Mechanics problems using appropriate choices of coordinates and integration techniques
- Apply Conservation Law Formalism (Energy, Momentum, Angular Momentum) to the description of single and multiple particle motion
- Explain the calculus of variations, particularly in the derivation of the Lagrangian formulation of Classical Mechanics
- Understand the Hamiltonian and Lagrangian formulations of classical mechanics and how they are related
- Set up and solve Classical Mechanics problems with the help of the Lagrangian Formulation
- Use the principles of classical mechanics to analyze standard systems, such as two-body central force problems and the rotation of rigid bodies
- Set up and solve problems involving systems of coupled oscillators

Lecture	Topic	Reading Material	Suggested Problems
1. W, 09/04	Mass, force, Newton's Laws	Ch. 1, 1.1 – 1.5	Ch. 1: 2, 5,10,18, 23,30
2. M, 09/09	Newton's II Law in Cartesian and Polar coordinates.	Ch. 1, 1.6 – 1.7	Ch. 1: 35,36,39,40,41,44,46,48,49
3. W, 09/11	Linear air resistance	Ch. 2, 2.1 – 2.3	Ch. 2: 1,2,5,7,8,11,12,13,15,16,18,21
4. M, 09/16	Quadratic air resistance, complex exponentials, and motion in E and B fields	Ch. 2, 2.4 – 2.7	Ch. 2:23,24,27,28,38,40,41,45,47,53
5. W, 09/18	Rockets, angular momentum	Ch.3, 3.1 – 3.4	Ch.3: 1,2,3,8,10,11,13,15,21,22
6. M, 09/23	Center of mass, angular momentum	Ch. 3, 3.4 – 3.5	Ch. 3: 25,27,29,31,32,34,35
7. W, 09/25	Kinetic and potential energy	Ch. 4, 4.1 – 4.2	Ch. 4: 2,3,4,5,7,8,9
8. M, 09/30	Force and potential energy	Ch. 4, 4.3 – 4.6	Ch. 4: 11,13,15,20,21,23,24,26,28
9. W, 10/02	Curvilinear systems, central forces	Ch. 4., 4.7 – 4.8	Ch. 4: 30,31,32,34,36,41,42
10. M, 10/07	Energy of interaction	Ch. 4., 4.9 – 4.10	Ch. 4: 46,47,52,53
11. W, 10/09	Oscillations	Ch. 5, 5.1 – 5.4	Ch. 5: 1,2,6,7,10,14,20,23,28
12. M, 10/14	Driven oscillations and resonance	Ch. 5, 5.5 – 5.6	Ch. 5: 33,40,42
13. W, 10/16	Fourier series, driven oscillations, and Parseval theorem	Ch. 5, 5.7 – 5.9	Ch. 5: 46,54
14. M, 10/21	Calculus of variations	Ch. 6, 6.1 – 6.4	Ch. 6: 1,3,4,7,9,11,13,17,23,25
15. W, 10/23	Midterm		
16. M, 10/28	Lagrange equations	Ch. 7., 7.1 – 7.2	Ch. 7: 1,2,3,4,6,8
17. W, 11/30	Lagrange equations with constraints	Ch. 7, 7.3 – 7.4	Ch. 7: 9,10,11
18. M, 11/04	Examples of Lagrange equations	Ch. 7, 7.5 – 7.7	Ch. 7: 14,15,16,18,20,21,23,27,29, 31,34,35,36,37,40,41
19. W, 11/06	Two-body, central force problem	Ch. 8, 8.1 – 8.5	Ch. 8: 1,3,6,7,8,10,13
20. M, 11/11	Kepler orbits	Ch. 8, 8.6 – 8.8	Ch. 8: 15,16,20,22,23,28,29,31,34
21. W, 11/13	Non-inertial frames	Ch. 9, 9.1 – 9.4	Ch. 9: 2,3,4,6
22. M, 11/18	Rotating frames	Ch. 9, 9.5 – 9.9	Ch.9: 9,10,11,13,14
23. W, 11/20	Rotating frames	Ch. 9, 9.5 – 9.9	Ch.9:16,18,19,20,26,28,29
24. M, 11/25	Rotation about a fixed axis	Ch. 10, 10.1–10.2	Ch. 10: 2,3,5,8,9,10,12,15,18
25. M, 12/02	Inertia tensor and principal axis theorem	Ch. 10, 10.3–10.6	Ch.10: 20,22,25,27,28,29,34,35,36,37
26. W, 12/04	Euler's equations	Ch. 10, 10.7–10.8	Ch. 10: 40,42,43,44,45,47
27. M, 12/09	Coupled oscillators	Ch. 11, 11.1–11.3	Ch. 11: 1,2,3,4,5,12
28. W, 12/11	Lagrangian approach	Ch. 11, 11.4–11.7	Ch. 11: 14,15,18,19,24,26,29,31

FIRST DAY OF CLASSES: Tuesday, September 3
LAST DAY TO WITHDRAW: Monday, November 11 (NJIT)
Thursday Classes Meet: Tuesday, November 26
Friday Classes Meet: Friday, November 27
THANKSGIVING RECESS: November 28 – December 01
LAST DAY OF CLASSES: Wednesday, December 11
READING DAYS: December 12, 13
FINAL EXAM PERIOD: December 15 – December 21
FINAL GRADES DUE: December 23