

Syllabus for Physics 411

Advanced Mechanics

Fall 2002

August 26, 2002

- **Catalog Description:** *Advanced Mechanics*. Three semester hours. A course in the Classical Mechanics of particles and rigid bodies. The methods of Lagrange and Hamilton are introduced. Prerequisites: Physics 211 or 317.
- **Supplemental Description:** This course explores the consequences of Newton's 3 Laws of Motion for bodies experiencing nontrivial forces and for systems of particles. Specific topics to be covered include damped and forced harmonic oscillators, an introduction to deterministic chaos, motion in rotating coordinate systems, systems of interacting particles, and an introduction to Lagrangian and Hamiltonian dynamics. Extensive use will be made of ordinary differential equations and some use will be made of vector and matrix operations, so Physics 317 or Math 315 and Math 335 are recommended before or while taking Physics 411.
- **Textbooks:**
 1. *Analytical Mechanics*, 6th edition, Grant R. Fowles and George L. Cassiday, Saunders College, 1999.
 2. *Theory and Problems of Theoretical Mechanics with an Introduction to Lagrange's Equations and Hamiltonian Theory*, Murray R. Spiegel, Schaum's Outline Series in Science, McGraw-Hill, 1967.

- **Lecture Time and Place:** MWF 10:00–10:50 PM Hall of Sciences Room 121

Instructor	Office	Contact Information
• Dr. Howard Richards	130 Sci WR 3:30–4:30	903-886-5882 Howard_Richards@TAMU-Commerce.edu

- **Goals of the Course:** Students will have a sound understanding of classical mechanics and will be well-prepared to see the connections with quantum mechanics and statistical mechanics. Specifically, students will

- be able to find the constants of motion
- understand the concept of phase space
- see how deterministic chaos is related to the increase of entropy
- understand generalized coordinates, velocities, momenta, and forces
- be able to derive the Lagrangian and write the differential equations for generalized coordinates
- be able to derive the Hamiltonian and write the differential equations for generalized coordinates and momenta

- **Grade Distribution:**

50% Homework
 20% Midterm Exam
 30% Final Exam

- **Grade Scale:**

A : 85% and up
 B : 70% to 85%
 C : 55% to 70%
 D : 40% to 55%
 F : below 40%

- **Course Webpage and Schedule:**

The timing of specific lectures, tests, and homework assignments cannot be accurately foreseen at the beginning of the semester, so **an up-to-date list of lectures, tests, and homework assignments will be maintained on the course webpage,**

<http://www.tamu-commerce.edu/coas/physics/phys411/fall102/>.

An attempt will be made to announce the topics of lectures two weeks in advance. The webpage will also contain supplements, links to useful external web pages, and other items useful or necessary to the course. Students should periodically check it for updates.

Tentative Schedule

Week 1: (August 26, 28, 30) *Chapter 1* “Fundamental Concepts: Vectors”

Week 2: (September 2, 4, 7) *Chapter 2 (2.1–2.4)* “Newtonian Mechanics: Rectilinear Motion of a Particle”

Week 3: (September 9, 11, 13) *Chapter 3 (3.1–3.4)* “Oscillations”

Week 4: (September 16, 18, 20) *Chapter 3 (3.5,3.6,3.8)* “Oscillations”

Week 5: (September 23, 25, 27) *Chapter 4 (4.1–4.4)* “General Motion of a Particle in Three Dimensions”

Week 6: (September 23, 25, 27) *Chapter 4 (4.5,4.6)* “General Motion of a Particle in Three Dimensions”

Chapter 5 (5.1) “General Motion of a Particle in Three Dimensions”

Week 7: (September 30, October 2, 4) *Chapter 5 (5.2–5.4)* “General Motion of a Particle in Three Dimensions”

Week 8: (October 7, 9, 11) *Chapter 5 (5.6)* “General Motion of a Particle in Three Dimensions”

Midterm Review

Week 9: MIDTERM EXAM October 14

(October 16, 18) *Chapter 6 (BRIEF OVERVIEW)* “Gravitation and Central Forces”

Week 10: (October 21, 23, 25) *Chapter 7 (7.1, 7.2, 7.7)* “Dynamics of Systems of Particles”

Week 11: (October 28, 30, November 1) *Chapter 8 (8.1–8.3)* “Mechanics of Rigid Bodies: Planar Motion”

Week 11: (October 28, 30, November 1) *Chapter 8 (8.4, 8.5)* “Mechanics of Rigid Bodies: Planar Motion”
Chapter 9 (9.1) “Mechanics of Rigid Bodies in Three Dimensions”

Week 12: (November 4, 6, 8) *Chapter 9 (9.2–9.5)* “Mechanics of Rigid Bodies in Three Dimensions”

Week 13: (November 11, 13, 15) *Chapter 10 (10.1–10.4)* “Lagrangian Mechanics”

Week 14: (November 18, 20, 22) *Chapter 10 (10.5–10.9)* “Lagrangian Mechanics”

Week 15: (December 2, 4, 6) **REVIEW**

FINAL EXAM: (Monday, December 9, 10:30)

- **Attendance and Tardiness:** *Students are expected to be on-time and present for all class meetings.* Excused absences can be arranged prior to the class period being missed for appropriate activities as determined by the instructor. If an **emergency** results in an absence, the student should contact the instructor **as soon as possible** informing the instructor of the emergency and inquiring about ways to make up the missed class. The instructor will make judgements on how to handle the situation. Possible reasons for an excused absence are listed in the “Student’s Guidebook” under class attendance policy. Attendance and tardy records will be maintained and either or both may result in deductions from your overall grade.
- **Classroom Behavior:** Disorderly conduct which interferes with the normal classroom atmosphere will not be tolerated. The classroom instructor is the judge of such behavior and may instruct a disorderly student to leave the room with an unexcused absence or in more serious situations a student may be removed from the class with a failing grade.
- **Cheating and other Breaches of Academic Conduct:** Students are encouraged to study and work homework problems together. If properly done, this is an excellent method of learning the material. However, students should *not* simply copy each other’s homework without understanding it; there is no learning value in rote copying. If a

group of students turns in identical work and any of them, upon questioning, shows by a total lack of understanding of the answer he or she has turned in that he or she has simply copied the answer, *all students in that group will receive no credit for the copied work*. Academic cheating, plagiarism, and other forms of academic misconduct may result in removal of the student from class with a failing grade or may in extreme cases result in suspension or expulsion from the University as described in the “Code of Student Conduct” section of the “Student’s Guidebook”.

- **Homework Assignments:** All homework assignments are due at the *beginning* of the class on the assigned due date. 10% will be deducted from the score of the assignment for each class meeting the homework is late.
- **ADA Eligible Students:** ADA eligible students should make arrangements with the instructor in the first week of the semester about special arrangements needed for classroom or testing facilities and procedures to accommodate the disability.
- **Evaluation of Instruction:** Students will be given opportunities to evaluate instruction near the end of the semester. The physics department utilizes a scantron graded questionnaire with statements regarding various elements of instruction and in addition utilizes an open ended form where students can make comments on all elements of the classroom. These comments are given to the instructor and department head soon after the grades are recorded. If students have concerns about the classroom experience during the semester they should inform the instructor of those concerns and failing a satisfactory response may, as a last resort, contact the physics department head with those concerns.