

PHYS 501: ADVANCED CLASSICAL MECHANICS

- Instructor: Dana Longcope, EPS 260D dana@physics.montana.edu
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- e-mail: dana@physics.montana.edu
- Office hours: Tues. 10:00 in EPS 260D
- Course web site: <http://solar.physics.montana.edu/dana/ph501/>
all assignments will be posted here.
- Text: Fetter and Walecka, *Theoretical Mechanics of Particles and Continua* (& copies of other material)

Grading:

- Homework assignments — one assignment every 1–2 weeks [$\sim 33\%$]
- 2×2 -hour exams (possibly evening) [$\sim 33\%$]
- Final Exam [$\sim 33\%$]

Objectives

- Classical Dynamics
 - Lagrangian dynamics
 - Constraints & forces of constraint
 - Continuum physics (intro)
 - Hamiltonian mechanics & phase space
 - Classical meets Quantum
- General Techniques
 - Linearization
 - Stability/instability of equilibria
 - Normal modes & “waves”
 - Using symmetry
 - Fourier methods
 - Hyperbolic equations (the wave equation)
 - Calculus of variations
 - Sturm-Liouville equations
 - General problem solving techniques

Course learning objectives:

Upon successful completion of this course, students should be able to:

- Formulate and solve classical mechanics problems using Lagrangian and Hamiltonian methods.
- Solve a problem which includes holonomic constraints and compute the forces of constraint.
- Linearize non-linear systems of equations about an equilibrium and solve the linearized system using normal modes.
- Use the calculus of variations to characterize the function that extremizes a functional.
- Apply methods of classical mechanics, including normal modes, to a continuum system such as a fluid.
- Use symmetries of a system to identify conserved quantities and predict the nature of normal modes of its linearization.

Course outline

- I. Lagrangian Dynamics (F&W Ch. 3)
- II. Small Oscillations & Normal Modes (F&W Ch. 4)
- III. Strings & Continua (F&W Ch. 7)
- IV. Fluids (F&W Ch. 9)
- V. Hamiltonian Dynamics (F&W Ch. 6)

Behavioral Expectations: Montana State University expects all students to conduct themselves as honest, responsible and law-abiding members of the academic community and to respect the rights of other students, members of the faculty and staff and the public to use, enjoy and participate in the University programs and facilities. For additional information reference see MSU's Student Conduct Code.

Collaboration: University policy states that, unless otherwise specified, students may not collaborate on graded material. Any exceptions to this policy will be stated explicitly for individual assignments. If you have any questions about the limits of collaboration, you are expected to ask for clarification.

Plagiarism: Paraphrasing or quoting another's work without citing the source is a form of academic misconduct. Even inadvertent or unintentional misuse or appropriation of another's work (such as relying heavily on source material that is not expressly acknowledged) is considered plagiarism. If you have any questions about using and citing sources, you are expected to ask for clarification.

Academic Misconduct: Section 420 of the Student Conduct Code describes academic misconduct as including but not limited to plagiarism, cheating, multiple submissions, or facilitating others' misconduct. Possible sanctions for academic misconduct range from an oral reprimand to expulsion from the university. Section 430 of the Student Code allows the instructor to impose the following sanctions for academic misconduct: oral reprimand; written reprimand; an assignment to repeat the work or an alternate assignment; a lower or failing grade on the particular assignment or test; or a lower grade or failing grade in the course. More serious sanctions require a Conduct Board hearing. You may wish to make explicit the minimum sanction you will impose for willful acts of academic misconduct.

Academic Expectations: Section 310.00 in the MSU Conduct Guidelines states that students must:

- A. be prompt and regular in attending classes;
- B. be well prepared for classes;
- C. submit required assignments in a timely manner;
- D. take exams when scheduled;
- E. act in a respectful manner toward other students and the instructor and in a way that does not detract from the learning experience; and
- F. make and keep appointments when necessary to meet with the instructor.

In addition to the above items, students are expected to meet any additional course and behavioral standards as defined by the instructor.

E-mail Policy: I expect that you will check your university email at least every 2 days.

From Students email policy:

Faculty will determine how electronic forms of communication (e.g., email, MyMSU course announcements, chats and message

boards) will be used in their classes, and will specify their requirements in the course syllabus. This official student electronic communications policy will ensure that all students are able to comply with electronic-based course requirements specified by faculty. Faculty can therefore make the assumption that students' official email and MyMSU accounts are being accessed and they can use email, MyMSU course announcements, chats and message boards for their classes accordingly.

Student Educational Records: All records related to this course are confidential and will not be shared with anyone, including parents, without a signed, written release. If you wish to have information from your records shared with others, you must provide written request/authorization to the office/department. Before giving such authorization, you should understand the purpose of the release and to whom and for how long the information is authorized for release.

Students have the right to access their educational records by appointment. This information is protected by the Family Educational Rights and Privacy Act (FERPA). For more information contact the Dean of Students office at 994-2826.