Physics 601 (Fall 2011): Classical Mechanics

Lectures

Tuesday and Thursday, 9:30am–10:50am in Small Hall 230

Instructor: **Wouter Deconinck**
Phone: (757) 221-3539
Office: Small Hall 343D
Office hours: Wednesday, 3:30pm – 5:00pm, or by appointment
Email: wdeconinck@wm.edu

Grader: **Zhen Wang**
Office: Small Hall 320A
Office hours (for questions on grading): Thursday, 3:30pm – 4:30pm
Email: zwang01@email.wm.edu

Textbook

- Required: Alexander L. Fetter & John Dirk Walecka, *Theoretical Mechanics of Particles and Continua*, Dover Publications (2003), ISBN 978-0-486-43261-8 (BN W&M Bookstore: $34.95; Amazon.com: $22.95).
- Supplementary: Herbert Goldstein, Charles P. Poole & John L. Safko, *Classical Mechanics*, 3rd ed., Addison-Wesley (2001), ISBN: 978-0-201-65702-9 or 978-0-321-18897-7 (BN W&M Bookstore: $167.90; Amazon.com: $118.00).

Goldstein is the *de facto* standard of graduate level classical mechanics courses, so you will not regret having it in your book case as a reference. However, Fetter & Walecka is comparable, and at a more affordable cost. Fetter & Walecka will be the main textbook for this course.

Readings

Fetter & Walecka will be the source of the majority of the reading assignments (if there will be reading assignments from Goldstein I will provide copies of the relevant pages). I expect you to read and understand the material in the sections that are assigned by the time you come to class. In class I will then briefly go over the material, focusing on the conceptual steps and difficult transition, while skipping the more tedious derivations. In class I will also expect that you can begin to apply the material to simple problems. If you would like me to spend some more time on one of the topics in the chapter, please send me an email by 8pm the day before class.

Homework

There will be 10 homework assignments during this course. The assignments will be posted on blackboard on Friday and are due in class the next Thursday. Late submissions will be accepted with a 50% penalty when submitted before the next Friday at 5pm. Deviations from these rules require advance permission from the instructor.

Grading

There will be a take-home midterm and an in-class final exam. The total grade will be calculated from your homework grades (40%), the midterm exam (30%), and the final exam (30%).

Schedule and Readings (subject to change)

Chapters 1 and 2 are assumed to have been covered in undergraduate courses. You might benefit from reading Sections 1—4, 6—11, if you have not been exposed to this material recently.

Th 8/25	Introduction, Notations Ch 3 Sec 13: Constrained Motion and Generalized Coordinates	p49-52
Tu 8/30	*Hurricane Irene*	
Th 9/01	Ch 3 Sec 14: D'Alembert's Principle Ch 3 Sec 15: Lagrange's Equations	p52-58
Tu 9/06	Ch 3 Sec 16: Examples	p58-60
Th 9/08	Ch 3 Sec 17: Calculus of Variations	p60-66
Tu 9/13	Ch 3 Sec 18: Hamilton's Principle Ch 3 Sec 19: Forces of Constraint	p66-71
Th 9/15	Ch 3 Sec 19: Forces of Constraint (cont.)	p71-77
Tu 9/20	Ch 3 Sec 20: Generalized Momenta and the Hamiltonian	p78-82
Th 9/22	Ch 6 Sec 32: Hamilton's Equations	p173-179
Tu 9/27	Ch 6 Sec 33: Example: Charged Particle in an Electromagnetic Field	p179-181
Th 9/29	Ch 6 Sec 34: Canonical Transformations	p181-184
Tu 10/04	Ch 6 Sec 35: Hamilton-Jacobi Theory	p184-191
Th 10/06	Ch 6 Sec 36: Action-Angle Variables	p191-196
Tu 10/11	*Fall Break (take-home midterm)*	
Th 10/13	Ch 6 Sec 37: Poisson Brackets	p197-203
Tu 10/18	Ch 4 Sec 21: Small Oscillations: Formulation Ch 4 Sec 22: Normal Modes	p86-95
Th 10/20	Ch 4 Sec 22: Normal Modes (cont.)	p95-101
Tu 10/25	Ch 4 Sec 23: Example: Coupled Pendulums	p101-108
Th 10/27	Ch 4 Sec 24: Example: Many Degrees of Freedom	p108-115
Tu 11/01	Ch 4 Sec 24: Example: Many Degrees of Freedom (cont.)	p115-119
Th 11/03	Ch 4 Sec 25: Transition from Discrete to Continuous Systems	p119-125
Tu 11/08	Ch 4 Sec 25: Transition from Discrete to Continuous Systems (cont.)	p125-130
Th 11/10	Ch 5 Sec 26: Rigid Bodies: General Theory	p134-139
Tu 11/15	Ch 5 Sec 26: Rigid Bodies: General Theory (cont.)	p139-144

	Ch 5 Sec 27: Euler's Equations	
Th 11/17	Ch 5 Sec 28: Applications	p144-154
Tu 11/22	Ch 5 Sec 29: Euler Angles Ch 5 Sec 30: Symmetric Top: Torque-Free Motion	p154-161
Th 11/24	*Thanksgiving*	
Tu 11/29	Ch 5 Sec 31: Symmetric Top: One Fixed Point in a Gravitational Field	p161-168
Th 12/01	Review	