CLASSICAL MECHANICS

Physics 316

KPTC 103 Noon – 1:20 p.m. [1]

Tuesdays and Thursdays – Fall Quarter 2008

This is a one-quarter course covering classical mechanics at the first-year graduate level.

There is no required text. You will probably want to consult at least one of the following recommended texts, available at the University of Chicago Bookstore or at Crerar on Reserve:

Herbert S. Goldstein, Charles P. Poole, and John L. Safko, *Classical Mechanics* (3rd ed.), Addison-Wesley, 2002 (ISBN 0-201-65702-3, QA805.G6 2002)

L. D. Landau and E. M. Lifshitz, *Mechanics* (3rd ed.), Pergamon, 1976 (ISBN 0-08-021022-8, QA805.L29 1976)

A. L. Fetter and J. D. Walecka, *Theoretical mechanics of Particles and Continua*, McGraw-Hill, 1980 (ISBN 0-07-020658-9, QA808.2.F47)

Jorge V. José and Eugene J. Saletan, *Classical Dynamics - A Contemporary Approach*, Cambridge, 1998 (ISBN 0-521-63176-9 [hardback] or 0-521-63636-1 [paperback], QA805.J73)

In addition, we will be "beta-testing" a new text on classical mechanics by Porter W. Johnson, `http://hep.uchicago.edu/~rosner/p316/pwj.pdf`. Suggested material for reading is summarized on the next page. Topics which may be discussed, time permitting, include Lagrangian and Hamiltonian formalisms, special features of motion in power-law potentials, the inverse problem, small oscillations and eigenvalue problems, accelerated coordinate systems, rigid body motion, action-angle variables, celestial mechanics, elementary hydrodynamics, nonlinear and dispersive systems, phase space methods, aspects of accelerator physics, and introductory concepts of chaotic behavior.

The course grade will consist of 50% for exercises to be assigned weekly, 15% for a midquarter exam to be given on Thursday, Oct. 30, 20% for the final examination, and 15% for a final project, due on the last day of class, Thursday, Dec. 4. The project may be undertaken in collaboration with another student if desired. Details will be circulated soon.

Course web site: `http://hep.uchicago.edu/~rosner/p316`.

[1] First meeting: Noon, Thursday, October 2. No class Thursday, October 9. September 30 and October 9 classes will be made up during the quarter.

Class Schedule
(two additional lectures will be arranged)

Week	Lecture dates	Recommended reading (a)	Subject
1	10/2	G1-2, L1-2, F1, J1, JS1	Equations of motion and conservation laws
2	10/7	G1-2, L1-2, F3, J2-3, JS2-3	Lagrangian formalism
3	10/14 10/16	G3, L3, F1, J6, JS2	Central force and one-dimensional problems
4	10/21	G3, L4, J7, JS4	Collisions
5	10/23 10/28	G6, L5, F4, J9	Small oscillations and eigenvalue problems
	10/30	Midquarter	
6 7	11/4 11/6 11/11	G4-5, L6, F2, F5, J4-5, JS8	Accelerated coordinate systems and rigid body motion
8	11/13 11/18	G8-10, F6, L7, J8, JS5-6	Hamiltonian formalism and canonical transformations
9	11/20 11/25	F9-10, J10, JS7-9	Hydrodynamics and nonlinear behavior
	11/27	Thanksgiving	
10	12/2 12/4	J9, JS7, (b)	Phase space problems and chaos

(a) G: Goldstein, L: Landau and Lifshitz; F: Fetter and Walecka; J: Johnson; JS:José and Saletan. Numbers refer to chapters.
(b) H.-O. Peitgen *et al.*, *Chaos and Fractals — New Frontiers of Science*, Springer, 1992