Course: Classical Mechanics
Physics 521, Fall 2013
M,W,F: 10:10 - 11:00, Swain West 218

Instructor: Radovan Dermisek
e-mail: dermisek@indiana.edu
Office: Swain West 225
Office hours: when I am in and by appointment
Phone: (812) 856 6918
Website: http://www.physics.indiana.edu/~dermisek/
Other useful books:

L.D. Landau and E.M. Lifshitz, Mechanics
H. Goldstein, C.P. Poole and J.L. Safko, Classical Mechanics
J.R. Taylor, Classical Mechanics (undergrad level)
Chapter 3  Lagrangian Dynamics
13 Constrained Motion and Generalized Coordinates
   Constraints
   Generalized Coordinates
   Virtual Displacements
14 D’Alembert’s Principle
15 Lagrange’s Equations
16 Examples
   Pendulum
   Bead on a Rotating Wire Hoop
17 Calculus of Variations
18 Hamilton’s Principle
19 Forces of Constraint
   Pendulum
   Atwood’s Machine
   One Cylinder Rolling on Another
20 Generalized Moments and the Hamiltonian
   Symmetry Principles and Conserved Quantities
   The Hamiltonian

Chapter 4  Small Oscillations
21 Formulation
22 Normal Modes
   Simplest Case
   Coupled Problem: Formulation
   Linear Equations: A Review
   Coupled Problem: Eigenvectors and Eigenvalues
   Coupled Problem: General Solution
   Matrix Notation
   Modal Matrix
   Normal Coordinates
23 Example: Coupled Pendulums
24 Example: Many Degrees of Freedom
   Two N-Body Problems
   Normal Modes
25 Transition from Discrete to Continuous Systems
   Passage to the Continuum Limit
   Direct Treatment of a Continuous String
   General Solution to the Wave Equation with Specified Initial Conditions
   Lagrangian for a Continuous String
   Normal Coordinates
   Hamilton’s Principle for Continuous Systems

Chapter 5  Rigid Bodies
26 General Theory
   Motion with One Arbitrary Fixed Point
   General Motion with No Fixed Point
   Inertia Tensor
   Principal Axes
27 Euler’s Equations
28 Applications
   Compound Pendulum: Kater’s Pendulum and the Center of Percussion
   Rolling and Sliding Billiard Ball
   Torque-free Motion: Symmetric Top
   Torque-free Motion: Asymmetric Top
29 Euler Angles
30 Symmetric Top: Torque-free Motion
   Equations of Motion and First Integrals
   Description of Motion in Inertial Frame
31 Symmetric Top: One Fixed Point in a Gravitational Field
   Dynamical Equations
   Effective Potential
   Small Oscillations about Steady Motion

Chapter 6  Hamiltonian Dynamics
32 Hamilton’s Equations
   Review of Lagrangian Dynamics
   Hamiltonian Dynamics
   Derivation of Hamilton’s Equations from a Modified Hamilton’s Principle
33 Example: Charged Particle in an Electromagnetic Field
34 Canonical Transformations
35 Hamilton-Jacobi Theory
36 Action-Angle Variables
37 Poisson Brackets
   Basic Formulation
   Transition to Quantum Mechanics
Notes: available on my website.

Homework: there will be assignments about every week. Unless specified otherwise, they will be due exactly one week after they are assigned (typically on Wednesdays).

Late Assignments: Start work early on the assignment. No late homework will be accepted without my prior consent.

Grader: TBD
office: Swain West TBD
e-mail: tbd@indiana.edu

Exams: there will be two exams: a midterm exam and a final exam. The final exam will cover all material presented in lecture, discussed in the text, or included in the homework problems.

Grades: the course grade will be weighted as follows:

homework = 50%,
midterm exam = 25%,
final exam = 25%.

Letter grades will not be assigned to the exams or the homework.
Attendance: optional but highly recommended.

Academic honesty: I encourage you to discuss physics with your colleagues. It is an excellent way to learn. You can also discuss homework assignments with others in the class. However you are expected to write your own solutions!

Advice: work hard from the first day; study till you can derive every single formula; think about the meaning of equations you are deriving; think about applications; solve as many problems as possible.

Have Fun!!!