Portland State University
Department of Physics

PH 624: Classical Mechanics
Instructor: M.A.K.Khalil

Problem Set 3 (Chapters 6,8,9)

H. Goldstein, C.Poole and J.Safko, Classical Mechanics, (Addison Wesley, N.Y., 2002)

Chapter 6: Small Oscillations

Cooper: 6.4 - Double Pendulum and Beats - 2. Start with solution to 1.22
Crawford: 6.8 - Triangular Molecule - 2. Uses standard procedure
Fowler: 6.12a - Normal Modes of Vibration - 2. This and the next problem are modified forms of problem 6-12 in Goldstein. In 12a start by writing the T and V matrices for the general case where all 3 k's are different and the two masses are different. Do not solve this; it is tedious and not very instructive. For this part, take K1=K3=K, K2=α K and m=M (the two masses). K1 and K3 refer to the springs at the ends Now find the normal modes of vibration and solve for the motion. Take the limits α –> 0 and α –> infinity, and discuss the resulting frequencies and their physical significance.
Grist: 6.12b Same set-up as above except take the case K1=K2=K3=K and m=β M. Find the normal modes. Take the limits β –> 0 and β –> infinity and discuss the frequencies and their physical interpretation.
Hopkins: 6.16 - Steep potential oscillations -2. A thought provoking problem about when motion is simple harmonic.

Chapter 8: Hamiltonian Formulation of Classical Mechanics

Hudson: 8.1 - Legendre transformation -1
Illyas: 8.8 - Hamilton's Principle and Hamilton's Equations -1. Deriving Hamilton's equations without explicitly using the Lagrangian.
Karmaker: 8.13 - Double Pendulum -3. A bit tedious.
Keating: 8.14 - Hamiltonian and Conservation Laws - 3. Straightforward but rough algebra.
Kozell: 8.19 Complex Pendulum -3.

Chapter 9: Canonical Transformations

Kuperman: 9.2 Canonical Transformations and Generating Functions -2
Lankow: 9.6 More Canonical Transformations - 3