PHY 3003 SPRING 2016

Week of Feb 1

Reading: Taylor, Chapter 4.1-4.7 and 4.10-11. Chapter 4 of vol 1 of the Feynman Lectures on Physics is also recommended.

Homework: Due in class Feb 8. All problems count equally towards your grade. (Numbers refer to problems in Classical Mechanics, J. R. Talyor, 2005 Edition)

(1) A particle of mass $m$ moves subject to a one dimensional potential

$$U(x) = U_0 \frac{x^2 x_0^2}{x_0^4 + x^4}$$

(here $U_0$ is a constant with dimension of energy and $x_0$ is a constant with dimension of length).

(a) Sketch $U(x)$, identify all of the equilibrium points and indicate whether they are stable or unstable. Be sure your sketch shows proper behavior as $x \to \pm \infty$).

(b) Sketch the phase space orbits, indicating the bound, unbound and separatrix orbits and giving the energy of the separatrices.

(c) Sketch all of the orbits with energy equal to $U_0/4$.

(2) For the situation described in Taylor 4.36, please answer questions a-c asked in problem 1 of this set. Note that the coordinate is $\theta$ and the velocity is $\dot{\theta}$

(3) A particle of mass $m$ moves in one dimension in the half-plane $x > 0$ subject to the potential $U(x) = A/x$. If at time $t = 0$ the particle is at position $x = x_0 > 0$ with velocity $v = 0$ please find the subsequent motion $x(t)$.

Sketch the potential and the phase portrait

(4) 2.12

(5) 4.8

(6) 4.28